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**A CROSS-CULTURAL STUDY
OF SCIENCE CONCEPTUALIZATION
IN EGYPT AND ENGLAND**

BY

SALWA MOHAMED KHALIL

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Thesis submitted for the degree of
Doctor of Philosophy

UNIVERSITY OF DURHAM, SCHOOL OF EDUCATION

September, 1987



19 SEP 1988

A B S T R A C T

The cardinal objective of this research has been to investigate cross- culturally the performance of Egyptian and English children of ages 5 to 15 on science conceptualization in the light of Piaget's theory of cognitive development. Two integrated empirical studies were administered to a total of 891 subjects from the two countries.

The preliminary study assessed the preoperational children's (ages 5 to 11) understanding of the concepts of life and death. The 389 children who participated in this study of animism showed no evidence that animism is a spontaneous tendency of the preoperational child's mental structure universally demonstrated. Chi-square analysis revealed some small significant differences between Egyptians and English, and no significant differences between sexes. Kurskal-Wallis One-Way Anova indicated that there was a correlations between ages and correct responses.

A sample of 502 subjects (270 Egyptians, 232 English) of ages 11, 13, and 15 participated in the second study of the development of science concepts in the concrete and formal operational children. Nonparametric statistical technique of Mann- Whitney U test was used to compute the data obtained.

The results revealed that a small proportion of children attained the late concrete and formal operational stages, that the attainment of the stages was in correlation with age levels, that there was no definite age at which a child

attained a specific developmental stage, that there were very slight variations between Egyptian and English children's attainment of the late formal stage, that there was a relationship between gender and the attainment of late formal operation stage, and that the educational system was a factor in the performance of the children on science concepts. These findings tend to support Ausubel's theory rather than Piaget's theory of cognitive development.

DEDICATION

To my mother,

to my daughter, and

to the immortal land of love,
Egypt.

A C K N O W L E D G E M E N T S

Of the many kind and helpful people I have met in the course of preparing this thesis, I wish to express my deep gratitude to a few particularly significant ones:

Mr. Peter McDougall, my supervisor, whose outstanding patience, uncomplainingly careful revision, and unremittingly accurate remarks and guiding notices have been too essential and fruitful for the production of this thesis to be expressed in mere words, and

Professor, G.R. Batho of the School of Education, whose moral support, sincere encouragement and compassionate care, both academically and socially, have provided me with confidence and security without which this thesis would not have been completed.

I wish to express my gratitude to Mrs. Jacquelyn McDougall for her sincere efforts to help me to improve my English during the first year, and for her painstaking task of reading the script.

I thank the English and Egyptian headmasters and teachers of the schools chosen in Durham, Aswan, and Tanta for applying the tests. Their disinterested help in providing me with the children tested despite the crucial time, in preparing the classrooms for undertaking the tests, and in sparing no effort of cooperation has been a contributing factor in the study.

Thanks are also due to the staff of the University of Durham Computer Centre for their great help in typing and processing the data, especially Mr. John Steele, Dr. W.R. Williams, Mrs. H. Taylor, Dr.R. Smith, and Mr. H. Baker, also the staff of Durham University Library, especially those of the Education Section, Joyce Adams, Mary Herbert, and Joan Barrow.

I thank Mr. Martin Boulton in Durham Tourist Information Centre for providing me with maps and data concerning Durham, Mr. Les Barnes for the information about Durham schools, Dr. Richard Gott for his advice during the preparation of the science tests, Mr. M. Ibrahim for explaining and helping in solving some of the statistical difficulties I have met during the computer analysis.

I am indebted to the Egyptian Missions Department in Cairo, and the Egyptian Education Bureau in London for their financial support and continual help and care throughout my scholarship.

Last but foremost, without the support, understanding and love of my loving family, my husband Mohamed El-Shaer, and my daughter Ghadeer El-Shaer who were simply being themselves, this thesis would never have been completed.

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CHAPTER ONE

INTRODUCTION

'O mankind ! We created you from a male
and a female, and made you into nations
and tribes, that ye may know each other'.

(Kor'an, XLIX:13)



Two main considerations have motivated the present study. One is overwhelmingly patriotic and, of course, subjective, while the other is significantly objective and of great concern.

The first consideration has stemmed from the fact that Egypt, the researcher's mother land, has recently taken huge steps in promoting, developing and achieving the principle that 'education is like water and air' for the Egyptian people. This principle was declared by Taha Hussein, one of the leading educational, intellectual, and literary personalities in modern Egypt, whose contributions to the educational system in Egypt are outstanding despite his blindness.(1) His declared principle of the importance of education was adopted by the 1952 Revolution(2), which professed that education is a universal right for all people.(3) It is a bounden duty of the Egyptian Government to give every one the opportunity to have access to any school and to guarantee one's right to obtain the highest academic qualification according to one's own potential within the framework of

- 1- Georgie D.M. Hyde, *Education in Modern Egypt: Ideals and Realities*, Routledge and Kegan Paul, London, 1978, pp. 13,198.
- 2- *Egypt : Facts and Figures*, Arab Republic of Egypt, Ministry of Information, State Information Service, 1985, p. 96; and also *Country Profile : Egypt*, The Economist Intelligence Unit (1986-1987), London, 1986, p. 9.
- 3- Vada Hart, *Modern Egypt*, Arab Republic of Egypt, Ministry of Information, State Information Service, 1985, p. 34.

free education at all stages.(1)

In fulfilling this highly regarded educational goal and broadening the base of education, the Egyptian Government has established independent universities in most of the governates, twelve till 1982.(2) Due to the acceleration in building universities, newly established universities have been in dire need of teaching staff. Therefore, large numbers of newly appointed demonstrators, assistant lecturers and students have been granted scholarships and missioned abroad for training(3) in order to be well qualified to meet the needs of the universities. The researcher is one of those granted scholarship under these circumstances. Working at the Faculty of Education in Aswan, University of Assiut, and realizing the need for educational psychology staff, I found it my duty towards my country and university to qualify and specialize in educational psychology regardless of my previous training to study the teaching of science. Here lies the subjective and patriotic consideration which has motivated the present research.

As far as the second consideration is concerned, the modern world has lately witnessed an increasing interest in cross-cultural studies in the hope of obtaining more understanding of the psychological processes accompanying

- 1- *Statistical Year Book 1952-1983*, Central Agency for Public Mobilisation and Statistics, Cairo, Egypt, June 1984, p. 173.
- 2- Vada Hart, *Op.Cit.*, p. 36.
- 3- *Statistical Year Book 1952-1983*, pp. 173-74.

and controlling the child's development upon which better implications for education can presumably be made possible. These cross-cultural studies have taken theories of cognitive development in general and Piagetian tasks in particular as guidelines.

A few studies have been carried out in Egypt, but few of these can be considered completely cross-cultural, in the sense that they were confined only to Egyptian children with a theoretical comparison with European children drawn from other researchers' results (e.g. Nahid Waines, 1984; M. Mohamed Aly, 1979). Other studies were investigating the concepts of only one of the three branches of science (e.g. Soheir Salem Rashwan (1982) studying biological concepts), while Denis Hocevar et al (1984) were investigating test anxiety of Secondary School Certificate pupils in Egypt and Brazel, and N. V. Ciaccio (1976) was studying Erikson's theory of ego epigenesis. The need for surveying the Piagetian theory of the child's cognitive development vigorously prompted this study, since Piaget is universally regarded as one of the most distinguished and influential contemporary psychologists in the field.

Jean Piaget (1896-1980) - biologist, philosopher, logician, educator and above all developmental psychologist - lived a fully productive life which could be compared to that of Freud. In this respect, John H. Flavell (1963) describes Piaget's theory as follows:

Like Freudian theory, with which one is tempted to compare it in certain respects, Piaget's theoretical system is a detailed and complicated one, not renderable in a few mathematical or verbal statements. Unlike Freudian theory, however, the system in its totality has not been widely assimilated by others.(1)

Similarly, David Cohen (1983) argues that the likeness between Piaget and Freud lies in the fact that each of them made one area of psychology very much his own, that is to say Freud's analysis of the child's emotional and psychosexual growth is as important as Piaget's theory of the child's mind.(2)

Furthermore, after describing Piaget's genetic epistemology as one of the most influential theories in contemporary psychology, P.R. Dasen and A. Heron (1981) proceed to spell out that Piaget's contributions are no less important than those of Freud, because Piaget's influence on the social science of this century is permanent, even if the details of his theory may be questioned and will be reorganized with the progress of science.(3) Moreover, in the field of psychological science, Piaget's system is considered by Dasen and Heron the most complete and coherent attempt to discover the general laws which control the human mind simply because

- 1- John H. Flavell, *The Developmental Psychology of Jean Piaget*, D. Van, Nostrand Company, Inc., 1963, p. 1.
- 2- David Cohen, *Piaget: Critique and Reassessment*, Croom Helm Ltd., Beckenham, Kent, 1983, p. 1.
- 3- P.R. Dasen and A. Heron, "Cross-cultural Tests of Piaget's Theory", *Handbook of Cross-Cultural Psychology: Developmental Psychology*, ed. H.C. Triandis and A. Heron, Allyn and Bacon, London, 1981, vol. 4, pp. 296-97.

Piaget provides a theory which is not merely a psychological theory, but rather an epistemology, a philosophy of knowledge, albeit it is built upon empirical evidence: the outcome of 'painstaking observation of hundreds of children in various phases of their development'.(1)

In supporting this viewpoint, Margaret Boden (1979) ends her book, *Piaget*, with this conclusive statement:

there is a rich store of psychological insights and theoretical speculations, and a profusion of intriguing empirical observations and remarkably ingenious experiments, to be found in Piaget's pioneering work. Educational, developmental and cognitive psychology are all informed by his thought. And for those interested in the broader context of psychology, he raises important and still unresolved questions about the relation between individual sciences (such as biology and psychology), between science and philosophy, and between knowledge and wisdom.(2)

Nevertheless, and despite the controversial dispute on Piaget and his achievements in the field of developmental psychology, it is not intended in the present study to give a full account of Piaget's life and work but only to illustrate and discuss a few points which are relevant to the objectives of the research. Through Piaget's theory of cognitive development, the study aims to look into the effects, if any, of Western education on the learning of science and the development of science concepts in the

1- Ibid., p. 297.

2- Margaret A. Boden, *Piaget*, Fontana Paperbacks, 1979, p. 155.

minds of the Egyptian school children.

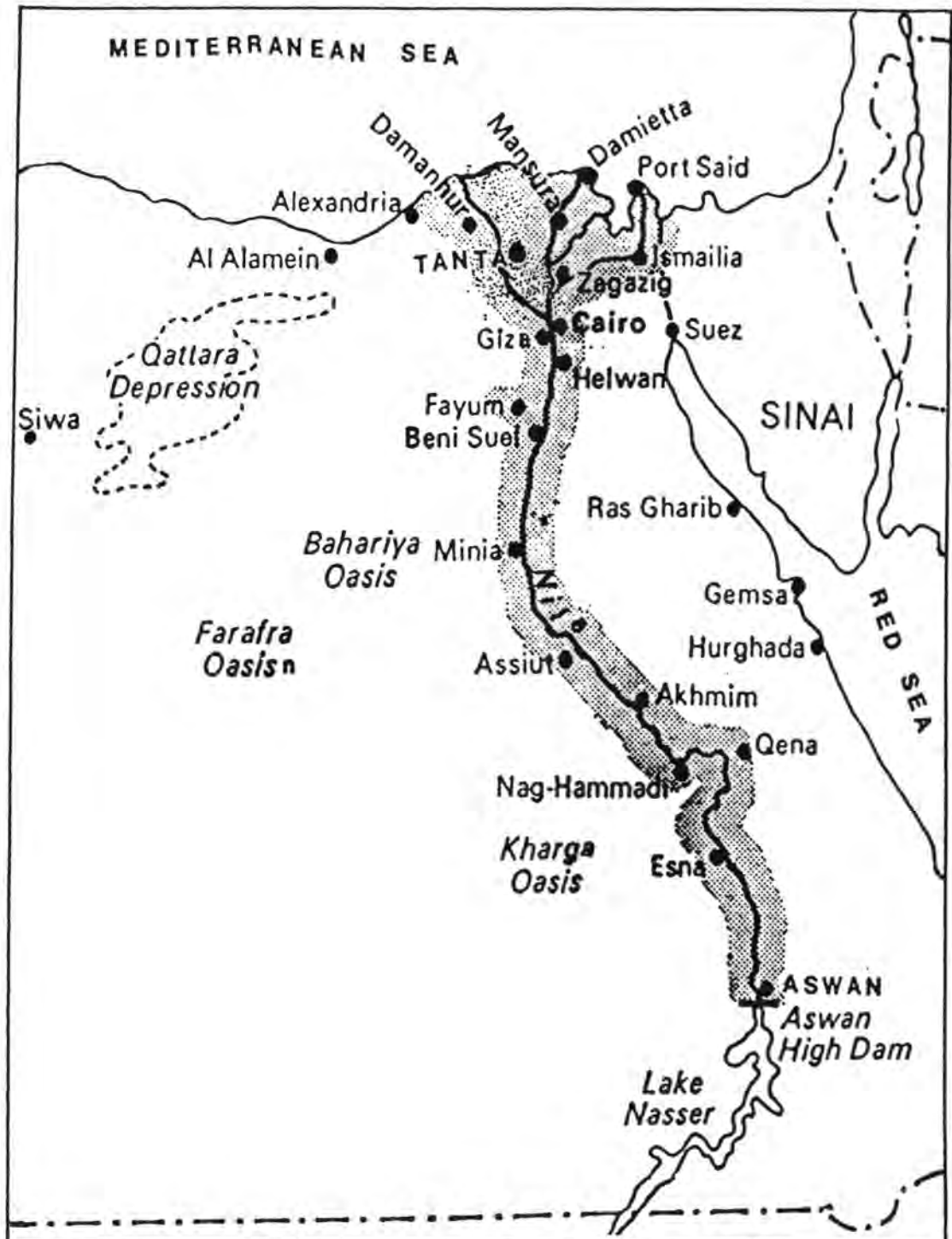
Therefore, the purpose of this study is to trace and criticize the three global stages of cognitive development in relation to Piaget's theory on the basis of scientific and experimental tests conducted on both English and Egyptian school children.

To be more specific, this study attempts to find out the answers to these two basic questions: does cognitive development in Egyptian culture follow the same sequential succession of stages as described and affirmed by Piaget and co-workers in Western children? If there are differences, what factors are responsible for these differences? Within the framework of these two questions other subsidiary questions need to be answered. The questions will be answered through:

1. A preliminary empirical investigation of animism administered on two samples of Egyptian and English children aged 5 to 11 years. The Egyptian children are taken from the schools and nurseries of the city of Aswan, located in the far south of Egypt (Map 1). The English children are selected from the schools of the city of Durham, located in the North East of England (Map 2).

2. An essential and integrated study including tests of assessment of scientific knowledge and concepts to be applied to secondary school children aged from 11-15 (i.e. the first five years secondary education in Britain, which

Map (1)



Geographical Location of the Egyptian Cities of
Aswan and Of Tanta

Map (2)



Geographical Location of the English
Historic City of Durham

are equivalent to the sixth year of primary schools, the three years of preparatory school and the first year of secondary schools in Egypt). Egyptian subjects are taken from the schools of Aswan and Tanta - the city of Tanta is located in the far North of Egypt, for its geographical location see Map 1. English children are taken from the schools of Durham.

Piaget wanted to find out how knowledge is constructed. His achievements lie in realizing the answer to the question where knowledge, by using the clinical or 'critical', as Lovell (1963) puts it (1), method of individually interviewing children, results from: does it result from the accumulation of small pieces of information or must there previously be a mental structure or reference frame inside which some new piece of knowledge can make meaningful? In answering this two-part question Piaget tends to be very much incompatible with both Gagne and Ausubel as will be illustrated in the next chapter.

- 1- Kenneth Lovell, 'Some Aspects of the Work of Piaget in Perspective', *Cognitive Development in the School Years*, ed., Ann Floyd, Croom Helm Ltd., London, 1979, p. 13.

THE ORGANIZATION OF THE THESIS

Chapter two is divided into two sections. Section one deals with general appraisals and criticism of Piaget's contributions and position in the field of developmental psychology. The same section surveys Piaget's theories of contradictions, and of the child's egocentricity. In the second section three of the most distinguished contemporary theories of cognitive development, namely Piaget's, Ausubel's, and Gagne's, are discussed, with special concentration on Piagetian theory.

The third chapter is devoted to a survey of the literature on cognitive development as regards studies of animistic thinking in the child's mind. These studies are reviewed apart from being cross-cultural or not.

In chapter four an applied investigation of animism is carried out on two samples representing Egyptian and English children aged 5-11 years old. Chapter four also includes the detailed methods and procedure, results, discussion and conclusion obtained from the results of this preliminary study.

In chapter five the term 'cross-cultural' is discussed in an attempt to define it as accurately as possible. This chapter also includes a review of the literature on cross-cultural studies and investigations.

Chapter six is a representation of methods and procedure adopted in the practical study of science concepts as performed by two samples of Egyptian and English children ranged from 11, 13, and 15 years old.

In chapter seven results and discussion of the cross-cultural study of science concepts undertaken on the children of the two cultures are presented.

A general conclusion based on both practical studies (animism and science concepts) is included in chapter eight in the light of the results obtained.

CHAPTER TWO

PIAGET AND COGNITIVE DEVELOPMENT

'We still have a great deal to learn about children's thinking, but at this stage Piaget's theory seems more useful than any other for possible application to science education. No other theory about children's thinking is so comprehensive and has at least its major aspects so well-supported by experimental evidence from many parts of the world.'

(Unesco Report, 1980)

* * * * *

PART ONE

GENERAL APPRAISAL AND CRITICISM OF PIAGET'S WORK

2.1.1 PIAGET AS SEEN BY OTHERS

The influence of Jean Piaget's work on the twentieth century developmental psychology is so great that, to quote Kenneth Lovell (1979), "most papers now published in the field of child psychology refer to his views in some way or other".(1) John H. Flavell (1963) sees Piaget as "one of the most remarkable figures in contemporary behavioural science"(2), while in a report made by Unesco (1980) he is described as the most influential thinker in the area of developmental psychology.(3) In the same spirit Rosalind Driver (1985) states that "science educators have found and continue to find his [Piaget's] work of immense interest and value".(4) Similarly, Eric Lunzer(1976b) appreciates Piaget as one of the outstanding psychologists of all time, who is "unique" in the field of developmental and cognitive psychology.(5)

- 1- Kenneth Lovell, "Some Aspects of the Work of Piaget in Perspective', *Cognitive Development in the School Years*, ed. Ann Floyd, Croom Helm, London, 1979, p.13.
- 2- John Flavell, *The Developmental Psychology of Jean Piaget*, D. Van Nostrand Company, London, 1963, p.1.
- 3- "Children's Development", United Nations Educational, Scientific and Cultural Organization (1980), in *Approaching Primary Science*, ed. B. Hodgson and E. Scanlon, Harper & Row, Publishers, London, 1985, p.87.
- 4- R. Driver, "Piaget and Science Education: A State of Decision", in *Ibid.*, p. 98.
- 5- Eric Lunzer, "An Appreciation of Piaget's Work", in *Piaget, Psychology and Education*, ed. Ved Varma and P. Williams, Hodder and Stoughton, London, 1976, p.3.

Commenting on Piaget's death, David Cohen (1983) shares the same evaluation of Piaget when he describes him as one of the world's great psychologists. To him, Piaget was like Freud in the sense that Piaget managed to make one area of psychology very much his own. David Cohen elaborates this idea by stating that if Freud's analysis was centred on the emotional and psychosexual growth of the child, from birth to maturity through pre-ordained stages, Piaget concentrated on the life of the mind; Piaget's field was logic, not libido.(1) More recently, Richard Kitchener (1986) believes that Anglo-American epistemologists and philosophers of science have a great deal to learn from Piaget, the "great child psychologist", since Piaget is universally acknowledged as "one of two or three most significant figures in twentieth-century psychology".(2)

As a reader in philosophy and psychology at the University of Sussex, Margaret Boden (1979) brings into prominence the importance of Piaget as an intellectual force in the field of psychology. Boden asks those who today have a keen interest in psychological and epistemological enquiry to read Piaget, though she at the same time reminds them that "he is usually vague and often wrong, and that there are still-uncharted dimensions of

- 1- David Cohen, *Piaget: Critique and Reassessment*, Croom Helm Ltd., Beckenham, Kent, 1983, p. 1.
- 2- Richard Kitchener, *Piaget's Theory of Knowledge: Genetic Epistemology & Scientific Reason*, Yale University Press, New York & London, 1986, pp.vii-1.

structural and procedural complexity within the mind that he seemingly has little inkling of. But yes - read Piaget".(1) In addition, Richard Kimball (1980) expresses a slightly different appreciative point of view. He proclaims that Piaget's findings draw the attention of not only researchers and educators but also health workers and parents all over the world.(2)

In terms of quantitative assessment, Sohan Modgil and Celia Modgil (1976) draw the reader's attention to Piaget's devotion and indefatigability in research. They find his eighteen thousand printed pages equivalent to seventy-five books of the two hundred and fifty pages. The significance of this new numerical evaluation lies in the fact that these works "... constitute the largest repository of knowledge about the cognitive development of children that is available anywhere.(3) In a later work, S. and C. Modgil (1982) identify Piaget as "one of the giants in the history of psychology", in accordance with the evolutionary process of the development of understanding and change of attitude.(4)

Moreover, to stress the position Jean Piaget holds in

- 1- Margaret Boden, *Piaget*, p. 155.
- 2- R. Kimball, "Affective and Cognitive Development: the Psyche and Piaget", in *Toward a Theory of Psychological Development*, ed. S. and C. Modgil, NFER Publishing Company, 1980, p. 147.
- 3- S. and C. Modgil, *Piagetian Research: Compilation and Commentary*, NFER Publishing Company Ltd., Windsor, Berks, 1976, V.1, p. 17.
- 4- S. and C. Modgil, *Jean Piaget : Consensus and Controversy*, Holt, Rinehart and Winston, London, 1982, p. 1.

developmental psychology as one of its giants, David Elkind (1970) highlights the growing number of books and articles dealing with Piaget's work as a complete subject-matter or a partial participation. This statistical evaluation which reflects the prevailing interest in Piaget's work is clearly emphasised by the fact that at the 1969 annual meeting of the National Educational Research Association in Chicago, eleven of the sessions dealt directly or indirectly with Piaget's research and theory.(1) At any rate, space does not allow to cite all notes of tribute paid by numerous commentators in recognition and appreciation of the influence and contribution of Piaget's achievement. These notes of praise are not exclusive to those who agree with him, but extend to include even those who disagree with his findings.

On the other hand, Piaget is also subject to much criticism. For instance, Hermina Sinclair (1974) denies the enormous influence of Piaget's theory on education, describing it as "comparatively little", and an application of his work to education is "far from obvious". The reason in Sinclair's opinion is that Piaget's interests are the development of knowledge, not skills or information.(2) It would be repetitive here to

- 1- David Elkind, *Children and Adolescents, Interpretive Essays on Jean Piaget*, Oxford University Press, London, 1974, p. ix.
- 2- H. Sinclair, "From Preoperational to Concrete Thinking and Parallel Development and Symbolization", in *Piaget in the Classroom*, ed. M. Schwebel & J. Raph, Routledge & Kegan Paul Ltd., 1974, p. 40.

cite works criticising Piaget, since criticisms relevant to the content of the thesis are discussed, each in its proper place in the following chapters. It suffices here to refer to some works that include various aspects of criticism to Piaget's findings and technique in a way or another (e.g. Wallace, 1972; Palfrey, 1972; Novak, 1978; Steiner, 1974; Berzonsky, 1971a and 1971b; Uzgiris, 1973; Flavell, 1977; Laurendeau, 1977; Strauss, 1951 and 1954; Bovet, 1976; Price-Williams, 1975; Philp and Kelly, 1974; Smillie, 1972; Donaldson, 1979; Bryant, 1982 and 1983; Bryant and Trabasso, 1971; Bullock, 1985; Parsons, 1960; Boden, 1983; Brown and Desforges, 1977 and 1979; Ennis, 1982; among many other authors).

2.1.2 INFLUENCE OF BIOLOGY

Kenneth Lovell (1979) points out that by means of using the clinical, or rather 'critical', method of individually interviewing children, Jean Piaget tried to build a bridge between his early love of biology and his continuous passion of epistemology.(1) In support of this statement, Margaret Boden(1979) along with Otaala (1980)(2), stresses the idea of the influence of both biology and philosophy on Piaget's psychological findings by giving a full account of how he did not engage in studying psychology for its own sake, but as a means to develop a biologically

1- Op.Cit., p. 13.

2- B. Otaala, Programme on Concept Development in African Children, Report of the Concept Formation Programme: A Workshop Held in Nairobi, Kenya, 17-27 Sept., 1974, Published Gaborone - Botswana, 1980, p. 3.

oriented theory of the nature and origins of knowledge. Boden gives evidence to this idea by quoting an autobiographical statement from Piaget himself: "Between biology and the analysis of knowledge I needed something other than philosophy ... a need that could be satisfied only by psychology".(1)

Moreover, Boden proceeds to identify this fact with the reason why Piaget's views on the justification and the inevitability of operational knowledge are debated and disputed in some way or other by many philosophers in general and most biologists in particular.(2)

Following the same line of investigation, Lunzer(1976a) emphasises that Piaget's preceding study of biology was greatly used in favour of his psychological researches. His central theme of psychological equilibrium, as well as his basic idea of intelligence as the organism's adaptation to its environment, rested heavily on his study of biology. Hence Piaget's study of psychology in general and of the origins of cognition in particular was "a natural extention" of his work as a biologist.(3) The idea is also traced and stressed by Ginsburg and Oppen (1969), who indicate that even the term 'equilibrium' is borrowed from physics. It implies a balance, a harmonious adjustment between at least two factors, and Piaget uses

1- *Op.Cit.*, p. 14.

2- *Ibid.*, p. 88.

3- E. Lunzer, "Jean Piaget: a Biographical Sketch", in *Piaget, Psychology and Education*, ed. V. Varma and P. Williams, p. xi.

it in terms of a balance between the individual's mental actions (cognitive structures) and his environment.(1)

Johanna Turner (1981) elaborately outlines how deeply biology participated in Piaget's theory of development. She sees him maintaining three fundamental postulates:-

- 1- internal organization, which characterises the human organism as well as all other biological entities,
- 2- invariant functions, which implies that internal organization is responsible for the organism's unique mode of functioning, which is always present and not subject to change over time, so it is "invariant",
- 3- the contact between the organism and its environment, by means of invariant functioning, results in the organism's adaptation of its cognitive structures.(2)

2.1.3 THE MOUNTAINS TASK AND EGOCENTRICITY

It must again be emphasised that even those who tend to criticise Piaget on some fundamental grounds cannot deny the respect they have for his achievement to the field of developmental psychology. Margaret Donaldson (1979) in her book, *Children's Minds*, starts off her preface with admitting her indebtedness to Piaget whose work she has to criticise. On the other hand, she finds her criticism does not lessen her respect for him as far as his vast

- 1- Herbert Ginsburg and Sylvia Oppen, *Piaget's Theory of Intellectual Development: An Introduction*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1969, p. 14.
- 2- Johanna Turner, *Cognitive Development*, Methuen & Co. Ltd., London, 1981, p. 13.

contribution to knowledge is implied.(1) Nevertheless she vigorously refutes Piaget's claim that children under the age of six or seven are very bad at communicating because they are bad at decentring, that is to say, they are highly 'egocentric'.

Piaget and Inhelder (1963) believe that young children usually relapse into egocentric constructions. According to Piaget, the child is egocentric in his representations of objects, and in his social relations. As regards the first category, the child lacks the ability to imagine an object from the perspective of another person because the actions are still centred on the body. Flavell (1963) explains that the child frequently shows a relative incapability of taking the role of the other person; he is unable "to see his own viewpoint as one of many possible and to try to coordinate it with these others.... unable to reconstruct a chain of reasonings which he has just passed through."(2) For the second category of egocentricity in social relations, the child demonstrates his inability to take another person's point of view. "It is social interaction", to use Flavell's (1963) words, "which gives the alternate *coup de grace* to childish egocentrism".(3)

Relevantly, Richard Kitchener (1986) refers to what he

- 1- Margaret Donaldson, *Children's Minds*, (Fifth Impression) Fontana/Collins, Glasgow, 1979, p. 9.
- 2- Flavell, *Op.Cit.*, p. 156.
- 3- *Ibid.*, p. 157.

sees as common misunderstanding and wide misinterpretation of Piaget's term of egocentrism. Kitchener believes that despite this misunderstanding of Piaget's use of the term, it constitutes a "core concept in his theory for which there is no easily available substitute name", and that the Piagetian term is certainly is confused by many with the same term in Freud's theory.(1)

Within this context, Donaldson (1979) thinks that Piaget was wrong in his belief that young children have no memory of previous states or, as she puts it, 'stills'. To prove that the difficulty which children face with the Piaget 'mountains' task does not arise, as she believes, from being egocentric, Margaret Donaldson makes a comparison between the Piagetian 'mountains' task on one side and the task devised by Martin Hughes (1975) on the other.(2)

Piaget and Inhelder (1963) used a model of three mountains which are distinguished from one another by different colours such as green, brown, grey, and by putting some features on the summits such as a house, a red cross and snow (see Fig. 2.1.1). The child sits at one side of the table on which this model is placed. A little doll is placed at some other position round the table. The child is asked: what does the doll see? The question asked by Piaget and Inhelder is divided into three types

- 1-Kitchener, *Op.Cit.*, p. 18.
- 2-Donaldson, *Op.Cit.*, pp.19-21.

of experiments.(1) In each type of the experiment, Piaget examines the ability of the child to imagine the view seen by the doll from a position different from his own.

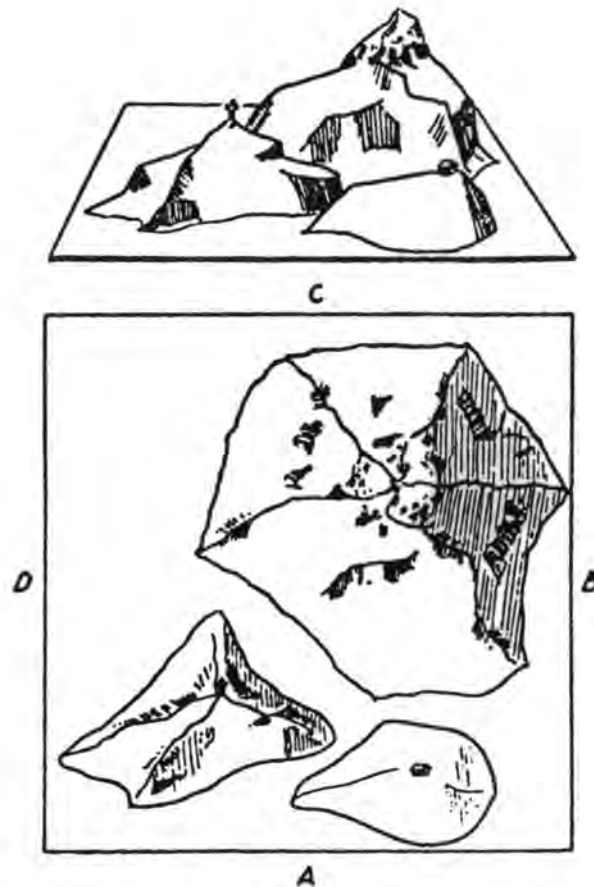


Fig.2.1.1

Piaget's Three Mountains Task(2)

Piaget indicates that children up to the age around nine distinguish hardly or not at all between their own

- 1- For more details of the three types of experiment carried out by Piaget see *The Child's Conception of Space*, Routledge & Kegan Paul, London, 1963, pp.211-2.
- 2- Adapted from *Ibid.*, p. 211.

viewpoint and that of the doll in different positions, and those who show some attempt at discrimination relapse into egocentricity, in other words they are unable to 'decentre' in imagination.

According to Margaret Donaldson and Martin Hughes, this is not the case. They consider that Piaget is wrong on the ground that the problem is introduced to the children by Piaget in a wrong way.

As far as Hughes' task is concerned, he uses two 'walls' intersecting to form a cross, and two small dolls, representing respectively a policeman and a little boy. Seen from above, the lay-out (before the boydoll is put in position) displaying that the policeman is initially placed as in Fig. 2.1.2.

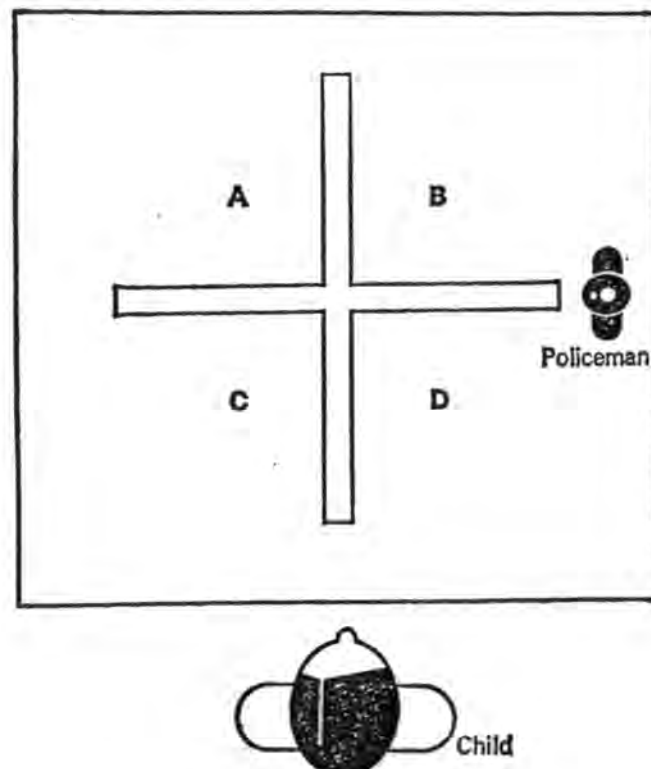


Fig.2.1.2 Hughes' Task (First Experiment)

Then the child is asked if the policeman can see the boydoll if it moves to sections A, B, C and D in turn. Next the policeman is placed on the opposite side, facing the wall that divides A from C, and the child is asked to hide the doll so that the policeman can't see it. Hughes found very few mistakes were made. Then the task is made more complicated by adding another policeman and the two are placed as in Fig. 2.1.3.

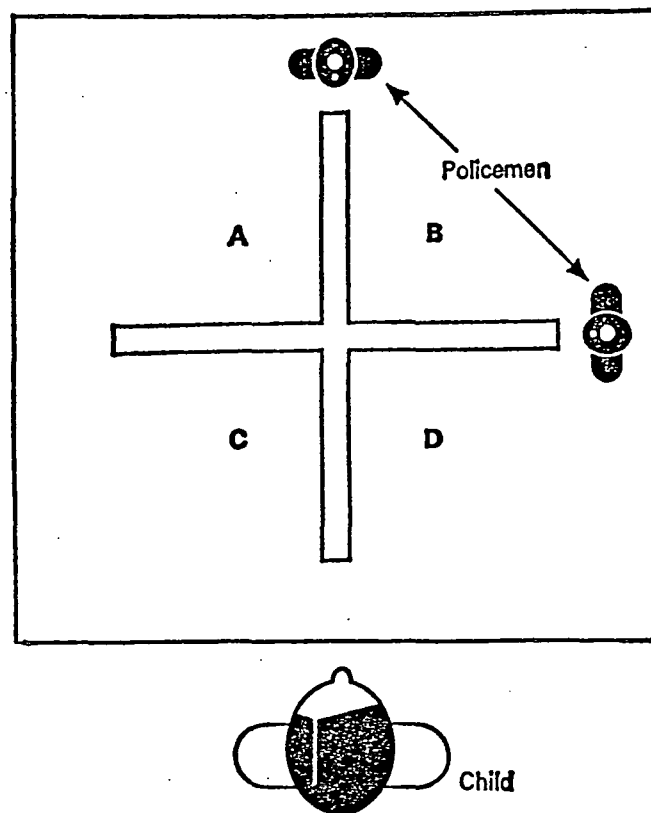


Fig.2.1.3 Hughes' Task (Second Experiment)

Hughes' findings were diametrically opposite to that of Piaget. Whereas the responses of the children to the mountains problem of Piaget were egocentric, Hughes found 90 per cent of the children's responses to the policeman

problem were correct. The reason claimed by Donaldson is that in the mountains task of Piaget, the children do not fully understand what they are supposed to do, whereas the policeman task of Hughes creates a situation which 'makes sense' to the child, and is easy for him to grasp, or as she puts it:

The *motives* and *intentions* of the characters are entirely comprehensible, even to a child of three. The task requires the child to act in ways which are in line with certain very basic human purposes and interactions, (escape and pursuit) - it makes *human* sense.(1)

Furthermore, Donaldson points out that in another study Hughes used a simplified version of the mountains task, and he found it possible to get a high proportion of correct responses from pre-school children provided great care was taken over the way in which the problem was introduced. From this she gives further support to the idea that Piaget's subjects did not understand the problem, which stood as an obstacle in their way of approaching correctly such degrees of abstractness.(2)

For Donaldson, egocentricity is a human characteristic present in children and adults alike. It cannot be excluded to children, since we are all egocentric in certain situations throughout the course of our lives. Sometimes the child may not be as egocentric as a sophisticated adult is. Her dispute with Piaget is "only about the extent - and the developmental significance - of

1- *Op.Cit.*, p. 24.

2- *Ibid.*, p. 23.

egocentrism in early childhood ... the difference between child and adult in this respect is less than he [Piaget] supposes".(1)

To support the views of Hughes and Donaldson, Karin Compton (1982) in her unpublished dissertation in which she performed a number of Piagetian tasks on a reception class, concluded that children aged around 5 years are still egocentric in so far as Piaget's model of the three mountains is applied. The child in this age is only able to see the world from his own position and he lacks the ability to put himself into another position or see something from another angle. This conclusion is compatible with Piaget's (1963) result that the child lives in the state of the moment, not bothering himself with how things were just previously, with the relation of one state to those which come before or after it.

Karin Compton, therefore used Martin Hughes' experiment and came to the conclusion that:-

- children are not at any age as egocentric as Piaget has claimed on the assumption that the taking of another point of view requires a certain effort, and the difficulty is bound to vary from one situation to another in many complex ways.

- children are not so limited in their ability to reason deductively as Piaget has claimed. At least from the age of 4 the gap is much smaller than

originally believed.(1)

In her attempt to assess Piaget's lasting contribution to the understanding of cognitive development in school years, Ann Floyd (1979) states that in spite of many controversial views on the significance of his work, Piagetian concepts are largely influential in this field of study. These concepts are sometimes interpreted in the Genevan way, other times they are modified, refined or extended, and yet they are sometimes vigorously subject to criticism.(2)

On the other hand, Geoffrey Brown (1983) suggests a sequence of requirements of which every teacher in training must be aware to achieve the goal of facilitating a child's learning of some curriculum item:-

1. to discover the present level of knowledge and understanding possessed by the learner,
2. to find a way of organizing and presenting the new information in a way compatible with the present level of understanding, and
3. to then engage the learner and the task.(3)

- 1- K. Compton, Evaluation of Piaget's Contributions to Education in the Light of Recent Criticism, P.G.C.E. Dissertation, University of Durham, 1982, p. 28.
- 2- Ann Floyd, *Cognitive Development in the School Years*, p. 11.
- 3- Geoffrey Brown, 'Piaget's Theory and Educational Psychology', *Jean Piaget : An Interdisciplinary Critique*, ed. Sohan & Celia Modgil and G. Brown, Routledge & Kegan Paul, London, 1983, p. 95.

To Brown, the Piagetian model seems to give guidance at each point he suggests in this sequence. Still, on closer inspection the difficulties of implementation cannot be overcome. His conclusion is that Piagetian theory does not help directly in the psychology of education because children's operations are judged by entirely unclear means and the invariant sequence of stages does not reflect some basic principle in the learner's cognitive processing. Moreover, he describes its contribution as "... a sensitivity to detail, a desire to understand the child's 'mistake' rather than dismiss it - but in specific classroom practice ... The neatness of structuralism has taken us too far from the real world of the classroom".(1)

2.1.4 PIAGET'S THEORY OF CONTRADICTIONS

Piaget's theory of contradictions is strongly expounded in Piaget (1978 , 1980) though it is implied throughout his previous writings. Piaget maintains that the child in his early stages cannot classify objects properly. This Piagetian claim has been criticised by many scholars among whom are Bryant and Trabasso (1971), Bryant (1982 , 1983), McGarrigle and Donaldson (1975), and Markman (1979), among others. To Piaget, the child's contradictions can happen for several reasons the first of which, as Bryant (1983) explains, is that "what seems to the child to be the same action can lead, on different occasions, to quite

1- Ibid., pp.100-101.

different results, and this provokes a dilemma which the child solves only by understanding eventually that not one, but two or more different actions, are involved.(1)

The second reason is that the child does not have the ability to classify objects properly. There is also the reason that the child makes incorrect inferences. According to Piaget, contradiction impedes the child's behaviour and he gets frustrated because of his failure in achieving some goal. This frustration results in the disturbance that stimulates or motivates the next step which is regulation or modification of a particular piece of behaviour. If the child starts to modify what he has done, he paves the way for himself to move to the next step which is called compensation.

In this respect Peter Bryant illustrates this point by saying that compensation means finding and performing the opposite action which cancels out the effect that the first action has produced. Here the child is going through experimental actions which produce and which cancel out particular effects and this eventually leads to the final and most important step in this chain of events which is equilibration.(2)

Thus, Piagetian contradiction leads to intellectual improvements of the child through emerging a new and more

- 1- Peter Bryant, "Piaget's Struggle and the Struggle about Piaget", *Jean Piaget: An Interdisciplinary Critique*, ed. S. & C. Modgil and G. Brown, p. 250.
- 2- Ibid., p. 250.

advanced logical structure which allows the child to understand what has seemed to him incomprehensible beforehand. Bryant again, thinks that the evidence offered by Piaget's colleagues to support this suggestion is "very, very weak" on the assumption that this theory has empirical difficulty and a serious conceptual problem because it tells the child what is wrong without telling him what is correct. Thus, its final achievement is only propelling the child away from what is wrong and leaving him without any guide to show the right way.(1)

Bryant's argument and views are partially substantiated by Wallace (1972), while completely repudiated by McNally (1974) who has found evidence in his investigation to substantiate Piaget's theory of the child's contradictions.

1- Ibid., p. 251.

PART TWO

COGNITIVE DEVELOPMENT

2.2.1 AN OUTLINE OF PIAGET'S THEORY

Piaget's theory of intelligence begins with argumentative attempt to find an acquired definition of the term intelligence. Confronted by multifarious definitions of intelligence, he repudiates Claparede's definition of intelligence as 'adaptations of new situations' on the ground of its being 'too vague' and because trial-and-error behaviour occurs in the formation of habits, and also in the earliest established reflexes: when a new born baby learns to suck.(1)

He also discards Buhler's definition of intelligence as an act of immediate comprehension because of its excessive narrowness, though it seems to Piaget 'very precise'. Piaget argues that Buhler's definition confines the term to the limits of finding a solution to a problem while ignoring the preceding processes of the trial-and-error behaviour.

Piaget, however, professes several definitions of intelligence, most of which are somehow related to his biological knowledge: 'intelligence is an adaptation ... a

1- Jean Piaget, "The Stages of Intellectual Development of the Child", in P. H. Mussen, J. J. Corger and J. Kegan, *Basic and Contemporary Issues in Developmental Psychology*, 1975, p. 184.

particular instance of biological adaptation', (1) and it is 'a system of living and acting operations'. (2) Piaget also defines intelligence as a form of equilibration, or forms of equilibration, toward which all cognitive functions lead. (3) Therefore, equilibration constitutes the keynote in Piaget's theory of development. It is also the inspiration for his theory and its overarching principle. (4) But to Piaget equilibration needs also a Piagetian definition. It is, he believes, the maximum of the activity and not a state of rest. This activity is defined as compensation which is 'the annulling of a transformation by an inverse transformation'. So, intelligence is defined in terms of active, coordinate interchanges or operations.

Due to this fundamental Piagetian principle of equilibration, the development of cognition in an individual is determined by a certain series of stages. According to Piaget cognitive development is distinguished by four 'great stages, or four final great periods: the sensori-motor stage, the pre-operational stage, the concrete operational stage and formal operational stage.

- 1- Jean Piaget, *The Origin of Intelligence in the Child* (Third impression), Routledge and Kegan Paul Ltd., London, 1970 (first published 1953), pp. 3-4.
- 2- Jean Piaget, *The Psychology of Intelligence*, Routledge and Kegan Paul Ltd., 1950, p. 7.
- 3- Piaget, "The Stages of Intellectual Development of the Child", p. 185.
- 4- John Phillips, *The Origins of Intellect: Piaget's Theory*, W.H. Freeman and Company, San Francisco, 1969, p. 10.

The Sensori-Motor Stage

This stage covers a period from birth to the age of two years. To Piaget, the child behaviour at this stage can be called intelligent, though his or her language does not yet develop.(1) This stage is characterized by pure external action.(2) The child's actions are coordinated under what is called sensori-motor scheme, which is 'the structure or organization of actions as they are transferred or generalized by repetition in similar or analogous circumstances'.(3) The child develops a 'reversibility' or 'decentration' in action in the sense that at the earliest weeks of the development his or her conception of space is a multitude of spaces, while the space becomes homogeneous containing all objects at 18 to 24 months of age.

Maier (1969) sees the Piagetian term sensori-motor as 'fitting' because it indicates the child's creation of a world of action entirely related to 'his desires of physical statisfaction within his immediate sensori experience'.(4) The child's coordination and assimilation of his actions or motor activities present the basic developmental tasks of this stage, or as Maier(1969) puts it in other words, 'the new organism ... must be able to

1- Op.Cit., p. 185.

2- Richard Kitchener, *Op.Cit.*, p. 17.

3- J. Piaget and B. Inhelder, *The Psychology of the Child*, Harper, New York, 1969, p. 4.

4-H.W. Maier, *Three Theories of Child Development: The Contributions of Erik H. Erikson, Jean Piaget, Pober R. Sears*, New York: Harper and Row, Publisher, (Revised Ed.), 1969, p.103.

conscious and voluntary repetition of responses. This marks the beginning of the child's psychic life when maturation '... no longer alters assimilated objects in a physio-chemical manner but simply incorporates them in its own form of activity'.(1) The child's perceptual recognition of objects is developed through repeated stimulation (e.g. hearing and looking at the same object, seeing and reaching - grasping the same object, reaching - grasping and sucking the same object).

Alluding to the Piagetian terms of 'primary' and 'circular', Phillips (1969) illustrates that the reactions are called 'primary' because they are centered on the infant's body rather than on external object, 'circular' because they are endlessly repeated. The pattern is this: (A) the child stumbles onto an act that produces a new experience and (B) repeats the act to reproduce the experience.(2)

- Secondary circular reactions (4-8 months): it is a continuation of the primary circular reaction patterns with an amalgamation of patterns developed earlier. At the beginning of this stage, the child is not at all interested in the novelty of a new object, which 'only arrests his curiosity fleetingly at the object immediately serves as aliment to habitual schemata'.(3) Yet, the child assimilates more awareness of the environment and

- 1- J. Piaget, *The Psychology of Intelligence*, p. 8.
- 2- John Phillips, *Op.Cit.*, p. 19.
- 3- J. Piaget, *The Origin of Intelligence*, p. 258.

intentionally develops a unified activity different in degree from his previous actions, and his interest enhances to include relations of objects to each other, which marks the beginning of a conception of general space.(1)

- Coordination of secondary schemata and its application to new situations (8-12 months): the outstanding feature of this stage is the child's increasing perception of objects that do not make immediate impression upon him. He can be aware of objects other than himself as causes, in the sense that he can be capable of reasoning to the extent that he either pushes, or waits for adults to remove, the object obstructing his perception. The child's behaviour is marked by a shift of interest from the action to its effect.

Another important feature is that the child during this stage shows an innate appreciation and primitive discrimination of quantity and number as in this example:

At 0;10(14) Laurent repeats *pa* when I say 'pa', *papa* for 'papa' and *papapa* for a number of 4 or more than 4.(2) Generally speaking, at this stage the three aspects of assimilation (repetition, recognition and generalization) 'tend to join together or to combine more and more closely'.(3)

- Tertiary circular reactions (12-18 months): newly

1- John Phillips, *Op.Cit.*, p. 25.

2- J. Piaget, *The Origin of Intelligence*, p. 241.

3- *Ibid.*

acquired activities are added to the circular repetition of previous actions. The child repeats his previous processes motivated by curiosity and a tendency towards novelty. Intellectual reasoning and rational judgment are more developed, and the child is more adept than he previously was at reacting to new situations, and at discovering new means. Thus, at this stage, which constitutes the functional and sensorimotor point of departure of experimental judgment,

the application of familiar means to new situations or the invention of new means constitute, from the same functional point of view, actual reasonings since ... the schemata used in the capacity of means (it makes little difference whether it is familiar or invented on the spot) is subsumed under the schemata characterizing the final end in the same way that judgments are put into a state of mutual implication in the framework of the conclusion. With regard to the comprehension of sign, it constitutes an intermediate term between judgment and reasoning. It is judgment inasmuch as it is immediate assimilation of the sign, and reasoning inasmuch as this assimilation is fraught with prevision, that is to say, with virtual deduction. But this intermediate state also finds its equivalent in verbal thought: Most judgments are implicit reasonings.(1)

Again, Phillips (1969) explains that the child's reaction during this stage is called 'tertiary' because instead of being pre-occupied with action of his own body, as in Primary Circular Reactions, or predominantly with the direct environmental consequences of these simple acts, as in Secondary Circular Reactions, the child now engages in 'experiments' in order to discover new properties of

1- *Ibid.*, p. 268.

objects and events.(1)

- The invention of new means through mental combinations (18-24): an advanced level of intellectual behaviour revealing more reliance on comprehension and thought occurs at this stage. The child becomes more mentally developed and aware of the properties of objects without connecting them to his physical demands. His mental abilities appear in forming a mental image of an object despite its invisible displacement. He can imitate, remember and reconstruct a model's characteristics, and his representation or imitation of an object is no longer based on its physical presence but on a mental one, though his success depends upon his intellectual capacity of identification, differentiation and imitation, which is not the same in all children and may vary in degree from one child to another:

When the subject sees object as distinct from himself and sees models as objects, models can no longer be assimilated wholesale; they are seen to be both different from and similar to the child himself. It is no longer only identity, but also similarity which becomes a source of interest. It is true that as yet it is only those models which have some analogy with the child's schemas which give rise to imitation. Those which are too remote from the child's experience leave him indifferent, as for instance unfamiliar movements which would have to be made without being seen.(2)

As a whole the child's knowledge of the world that is based exclusively on his actions is a kind of rationality built on success and not understanding since 'there are no

1- *Op.Cit.*, p. 30.

2- J. Piaget, *Play, Dreams and Imitation in Childhood*, London, William Heinemann Ltd., 1951, pp.50-51.

full-blown propositional logic'.(1)

The Pre-Operational Stage

This stage covers the period approximately from two to seven years, but it is generally divided into two substages or phases: the pre-conceptual phase which extends roughly from two to four years, and the phase of intuitive thought which covers the period from four to seven years. At the beginning of the pre-operational stage, language appears, and as it develops, the symbolic function of the child increasingly grows. Still, the child's symbolic function is primarily limited to his own personal reference. The meanings of words are not fully comprehended by the pre-conceptual child as they are by the adult. Nevertheless, the child's ability to differentiate signifiers (such as words and images) from significates (objects, events and experiences to which words or images may refer)(2) gradually increases with the growth of his verbal ability:-

This symbolic function then brings great flexibility into the field of intelligence. Intelligence up to this point refers to the immediate space which surrounds the child and to the present perceptual situation; thanks to language, and to the symbolic functions, it becomes possible to invoke objects which are not present perceptually, to reconstruct the past, or to make projects, plans for the future, to think of objects not present but very distant in space - in short, to span spatio-temporal distances much

1- Richard Kitchener, *Op.Cit.*, p.18.

2- For more elaboration of the two Piagetian terms 'signifiers' and 'singificates', see John Phillips (1981), *Piaget's Theory: A Primer*, W.H. Freeman and Company, San Francisco, pp.71,77.

greater than before.(1)

The child's ability of representation of the thought is not yet fully developed; he is not yet capable of reconstructing a total configuration of something in his thought. His representation of an event is confined to the immediate perceptions that have stimulated him beforehand. He lacks a representation as a whole because the operations are not yet formed, though there are 'representations which are internalized actions; but actions still centered on the body itself, on the activity itself'.(2) The pre-conceptual child 'has no stable, enduring, and internally consistent cognitive organization, no system-in-equilibrium, with which to order, relate, and make coherent the world around him'.(3)

The child at this stage judges and reasons objects and events by their external appearance, and his verbal concepts lack the generality and the genuine understanding of two concepts and objective logic. Hence, centring or 'centration' is a contributing characteristic at this stage, which alludes to the child's propensity to focus his attention on one aspect of an event. He is not yet mentally capable of directing his attention to all perceptual aspects of individual situations, and he 'tends to experience either the qualitative or quantitative aspect; he does not perceive both at once or any

1- J. Piaget, "The Stages of the Intellectual Development of the Child", p. 186.

2- Ibid., p. 187.

3- John Flavell, *Op.Cit.*, p. 158.

connective relationship between the notions of quantity and quality'.(1)

Another associated characteristic is the lack of reversibility. Inhelder and Piaget (1958) define reversibility as 'the permanent possibility of returning to the starting point'.(2) So, the principle of irreversibility means that the child is incapable of relating a whole to its interrelated parts, or composing into a single organized system the various compensating changes which result of a transformation of reality. Piaget sometimes called this the absence of the knowledge of conservation in all object properties, in the length surface, quantity, and weight of things, and he points out that the child's reasoning is still based on what he sees and not on the transformation itself because there is no conservation.(3) This is the result of another characteristic of the child's mental limitations at this stage, that is to say egocentricity, or egocentrism, which means the child's actions, thoughts, and reasonings are only centred upon himself. The child is unable to distinguish between himself and the outside world, for he lacks a sense of the self as distinct from the world.(4) Intuitive and subjective judgments constitute the most

1- Maier, *Op.Cit.*, p. 123.

2- Inhelder and Piaget, *The Growth of Logical Thinking from Childhood to Adolescence*, Routledge and Kegan Paul Ltd., London, 1958, p. 272.

3- Piaget, "The Stages of the Intellectual Development of the Child", pp.187-88.

4- For further discussion of the characteristic of egocentrism, see above pp. 20-29.

predominant feature of the child's thought at this stage:

the existence of intuitive thought ... is an additional confirmation of the importance of imitative and imaged accommodation in the initial phases of conceptual representation, and it can be explained as an intermediary stage in the development from symbolic preconceptual thought to operational thought. Thus in this, as in the earlier stage, it is the general relationship between assimilation and accommodation that determines both the relationship between play, imitation and adapted thought, and also the specific forms taken by adapted thought when equilibrium has been achieved.(1)

The Stage of Concrete Operations

This stage extends from seven to approximately eleven or twelve years. The emergence of true logical operations of symbolic function is the first major feature of this stage of concrete operations. The appearance of internalized mental representations during the late pre-operational stage is described as partially lacking logical peculiarities or intirely forming what is called an operation, because these representations are coloured with irreversibility. While the child at the concrete operations stage is well able to see and judge an event from different perspectives due to his realization of reversibility, and to his attainment to the level of a much more complete and integrated logical operations: 'The first operations of the manipulation of objects, the concrete operations, deal with logical classes and with

1- J. Piaget, *Play, Dreams and Imitation in Childhood*, p. 287.

logical relations, or the number'.(1) These elementary operations which constitute structures of wholes and are manifested by the child of the stage of concrete operations involve the classification of objects according to their similarity and dissimilarity, seriation, coordination and numerical operations. These operations belong to a logical structure called a grouping. Sohan and Celia Modgil (1976) outline the eight 'groupments' of classes and relations manifested in this period:

1- Hierarchical classification: Most children (CA 8/9 years) learn to comprehend the relationship of a whole with its parts. However, some children of eight years could not believe that a member of the class 'Genevan' could also be a member of the class 'Swiss', for to them an individual could not belong to two classes.

2- Seriation or Order of Succession: Ranking an order of succession is based on appreciation of differences, whereas, in classifying, similarities are observed as well as differences.

3- Substitution or Equivalence: Children learn to recognize such relations as $14=13+1=8+6=5+9$ in number work, demonstrating varied ways of achieving the same outcome. Other alternative subdivision of classes are learnt.

4- Symmetry: the understanding of reciprocity is typical

1- Piaget, "The Stages of Intellectual Development of the Child", p. 188.

of symmetrical relations. Children aged six appreciate that a distance is unaltered in whichever direction it is measured. At about eight years, most children comprehend that with two brothers each is a brother to the other.

5- Multiplication of classes: When a child organizes objects into subclasses by considering concurrently shape and colour he will arrive at four subclasses which can be described in terms of both systems at once. Children, by approximately nine years, succeed in making complex multiplications of classes.

6- Multiplication of series: A multiplication of series is employed when a square in a map is spotted by both a number and a letter.

7- One-to-many equivalence in classes : When, for example, shapes are classified into triangles, conic sections, and quadrilaterals, with their subclasses, a 'family tree' of classes is produced. All of the subclasses circle, ellipse, parabola, hyperbola belong to the embracing class of conic sections.

8- One-to-many equivalence in series: Piaget has postulated five laws which the operations obey and reversibility is the most important.(1) These five laws or properties are reversibility or inversion, associativity, composition or closure, identity, and tautology or iteration.(2)

- 1- S.and C. Modgil, *Piagetian research*, vol.1, pp.42-43.
2- Richard Kichener, *Op.Cit.*, p.19.

However, these logical operations are still concrete in the sense that they are applied only to concrete objects, and the child is able to manipulate these logical operations only when he manipulates the object concretely. In other words, 'these operations do not deal yet with propositions, or hypotheses, which do not appear until the last stage'.(1)

The Stage of Formal Operations

Between eleven and fifteen years of age the child is able to reach the culmination of his developmental accomplishment. The advanced steps taken by the concrete operational child towards reversible operational (reasonings in logical and infralogical groupings) are now manipulated by the formal operational child without limitations. They are full in scope and not limited or oriented towards concrete things and events in the immediate present as in preceding stages. Piaget (1975) states that in this final stage "the child becomes capable of reasoning not only on the basis of objects, but also on the basis of hypotheses, or of proportions".(2) With the attainment of this highest level of coordinating formal thinking, "a new form of equilibrium appears, encompassing all the partial fields covered by concrete thought and coordinating them into a general system".(3) Moreover, in another place Piaget (1950) sees that the difference between the formal

- 1- Piaget, "The Stages of the Intellectual Development of the Child", p. 188.
- 2- Ibid., pp. 188-9.
- 3- Inhelder and Piaget, *The Growth of Logical Thinking*, p. 255.

operational child, or rather adolescent, and the child of the preceding stage lies in the assumption that:-

The adolescent, unlike the child, is an individual who thinks beyond the present and forms theories about everything, delighting especially in consideration of that which is not. The child, on the other hand, concerns himself only with action in progress and does not form theories, even though an observer notes the periodical recurrence of analogous reactions and may discern a spontaneous systematization in his ideas."(1)

Relevantly, Inhelder and Piaget (1958) differentiate between the term *reality* as pertaining to other preceding stages and the term *possibility* as the most important characteristic of the formal thinking stage.(2) The term "possibility" means that the child's capability of dealing with mental problems and of manipulating hypotheses goes beyond his own realistic world. He is able to perform purely abstract operations different from and more complicated than operations based on concrete objects characterizing previous stages. The child's performance at this stage shows not only reasoning by hypotheses but also his ability to use the implications of propositional ideas.

Reasoning by possibility outside the child's realistic world is not "equivalent to imagination freed of all control and objectivity".(3) The child-adolescent of formal thinking is "capable of departures from reality,

- 1- Piaget, *The Psychology of Intelligence*, p. 148.
- 2- Flavell, *Op.Cit.*, p. 204.
- 3- Inhelder and Piaget, *The Growth of Logical Thinking*, p. 255.

but those departures are lawful; he is concerned with reality, but reality is only a subset within a much larger set of possibilities".(1)

In order to illustrate the difference between a concrete operational child and formal thinking child in surveying possibilities, the following two examples (one from each stage) taken from Inhelder and Piaget's (1958) experiments should be considered:

A GIVEN NUMBER of disparate objects are presented to the subject, who is asked to classify them according to whether or not they float on water. Then (the classification completed) he is asked to explain the basis of his classification in each case. Next, the subject himself experiments, having been given one or several buckets of water; finally, he is asked to summarize his observations, this latter request suggesting that he is to look for a law, if this has not already spontaneously occurred to him ... With the older subjects, in addition to the objects to be classified we present three cubes of equal volume having different densities and an empty cube with "plexiglass" or plastic walls (with a density of about one) to facilitate accurate comparisons with the density of water.(2)

The following two examples elaborate the difference between concrete and formal operations as regarding the problem of 'the law of floating bodies':-

BRU (9 years): *"The water can't carry the pebbles. The wood can be carried."* - *"And if it is pushed under?"* - *"It will come back up because the water isn't strong enough: it doesn't have enough weight"* [=this time the weight operates to maintain it at the bottom and no longer to carry it!]. And a moment later, *"The wood comes up when you let go because it springs up."* (3)

- 1- John Phillips, *Piaget's Theory: A Primer*. p. 160.
- 2- *The Growth of Logical Thinking*, p. 20.
- 3- *Ibid.*, p. 33.

FIS (12;6) ... comes close to solution, saying in reference to a penny that it sinks *"because it is small, it isn't stretched enough.... You would have to have something larger to stay at the surface, something of the same weight and which would have a greater extension."* (1)

In the first example it is obvious that BRU did not try to formulate any hypotheses in his explanations. He was confined to his concrete observations. Thus his answers revolved round the relationships of weights and forces comparing the weight of the body concerned with the weight or the force of water despite ascribing another imaginative characteristic to the wood i.e. 'springing up.' In the second example FIS did not limit himself to the concrete reality he was observing. He formulated a hypothetical relationship between the weight-to-volume ratio of the object (penny, something larger) and the weight-to-volume ratio of water. He tried to formulate a possible solution that transcended his observations of the immediate and the real, though he did not formulate his possibilities in purely scientific formulae.

This type of flexibility in considering many possible points of view and discarding partial reality is a new developmental attitude which cannot be attained before the age of twelve. In Inhelder and Piaget (1958) there are many examples of illustrating the systematic, exhaustive and propositional attempts of possibilities that separate the child of the formal stage from the child of the concrete operations. As a whole, what was lacking in the

Table 2.2.1
Piaget's Continuum of Cognitive Development

MODALITY OF INTELLIGENCE	PHASES	STAGES	APPROXIMATE CHRONOLOGICAL AGE
I. Sensorimotor Intelligence	Sensorimotor Phase	1. Use of reflexes	0 To 1 month
		2. First habits and "primary" circular reactions	1 to 4 / months
		3. Coordination of vision and prehension, "secondary" circular reactions	4 / to 9 months
		4. Coordination of secondary schemata and their application to new situations	9 to 12 months
		5. Differentiation of action schemata through "tertiary" circular reactions, discovery of new means	12 to 18 months
		6. First internalization of schemata and solution of some problems by deduction	18 to 24 months
II. Representative Intelligence By means of Concrete Operations	Preconceptual Phase	1. Appearance of symbolic function and the beginning of internalized actions accompanied by representation	2 to 4 years
	Intuitive Thought Phase	2. Representational organizations based on either static configurations or on assimilation to one's own action	4 to 5 / years
		3. Articulated representational regulations	5 / to 7 years
	Concrete Operational Phase	1. Simple operations (classifications, seriations, term-by-term correspondences, etc.) 2. Whole systems (Euclidian coordinates, projective concepts, simultaneity)	7 to 9 years 9 to 11 years
III. Representative Intelligence by Means of Formal Operations	Formal Operational Phase	1. Hypothetico-deductive logic and combinatorial operations	11 to 14 years
		2. Structure of "lattice" and the group of 4 transformations.	14 years-on

Source: Adapted from Table 3.1 in Maier, Op.Cit., p. 155.

preceding stages is now completed, systematized and integrated. Table 2.2.1 shows a comprehensive summary of Piaget's theory of cognitive development made by Piaget (1956).

2.2.2 GAGNE'S CONDITIONS OF LEARNING

Unlike Piaget, Robert Gagne (1970) does not ascribe intellectual development to the process of growth, but rather to an increased capability of some type of performance exhibiting itself as a change in human behaviour when an individual is placed in a 'learning situation'.(1) In other words an individual's cognitive development is not specified in terms of definite sequential age periods, each of which can be characterized by certain modes of learning and thinking exclusive to it as Piaget professes. The kind of change in human capability is described by Gagne as being not momentary but retained performance, which must also be distinguished 'from the kind of change that is attributable to growth, such as a change in height or the development of muscles through exercise'.(2)

According to Gagne a learning event or the change in performance has three elements:

- 1- a learner (e.g. a human being),
- 2- the events, stimulating the learner's senses

- 1- Robert M. Gagne, *The Conditions of Learning*, (Second Edition), Holt, Rinehart and Winston, Inc., London, 1970, p. 3.
- 2- *Ibid.*, p. 4.

(collectively described as the *stimulus situation*), or a single event (called a stimulus), and

3- the action resulting from stimulation and subsequent nervous activity (called a response): A learning event, then, takes place when the *stimulus situation* affects the learner in such a way that his *performance* changes from a time *before* being in that situation to a time *after* being in it. The *change in performance* is what leads to the conclusion that learning has occurred.(1)

Gagne divides learning conditions into two categories: a) conditions internal to the learner, defined as the set of initial capabilities possessed by the learner and determining the conditions required for subsequent learning, and b) conditions *external* to the learner, which are independent in their action.(2)

Without the existence of prior capabilities and relevant rules (internal conditions), the learner is not able to solve a problem, since the solution of a problem 'always depends upon previous experience of the learner, or more specifically on the recall of previously learned rules'.(3) Gagne (1970) provides several examples in order to illustrate the importance of such internal conditions in the process of problem solving. In one of these instances the student may be asked to demonstrate that the following statement, in which a and b are rational

- 1- *Ibid.*, p. 5.
- 2- *Ibid.*, p. 23.
- 3- *Ibid.*, p. 222.

numbers, is true:

$$(a + b)21 = a.21 + b.21$$

Gagne assumes that if the student has previously acquired certain relevant rules, he will manage to solve this equation in the following steps:

1. $(a + b)21 = 21(a + b)$; by the commutative property of multiplication
2. $(a + b)21 = 21.a + 21.b$; by the distributive property
3. $(a + b)21 = a.21 + b.21$; by the commutative property(1)

To the student, the problem consists in selecting and using certain number rules, which he has previously learned, in an order that will make it possible for him to arrive at a logically correct solution.

On the other hand, external conditions such as verbal instructions may "guide" or "channel" thinking in certain directions. At the same time the individual learner may be guided by self-instructions. But generally, "guidance of thinking takes the form of informing the learner of the goal of his activity, the general form of the solution; this amount of guidance appears to be required if learning is to occur at all".(2)

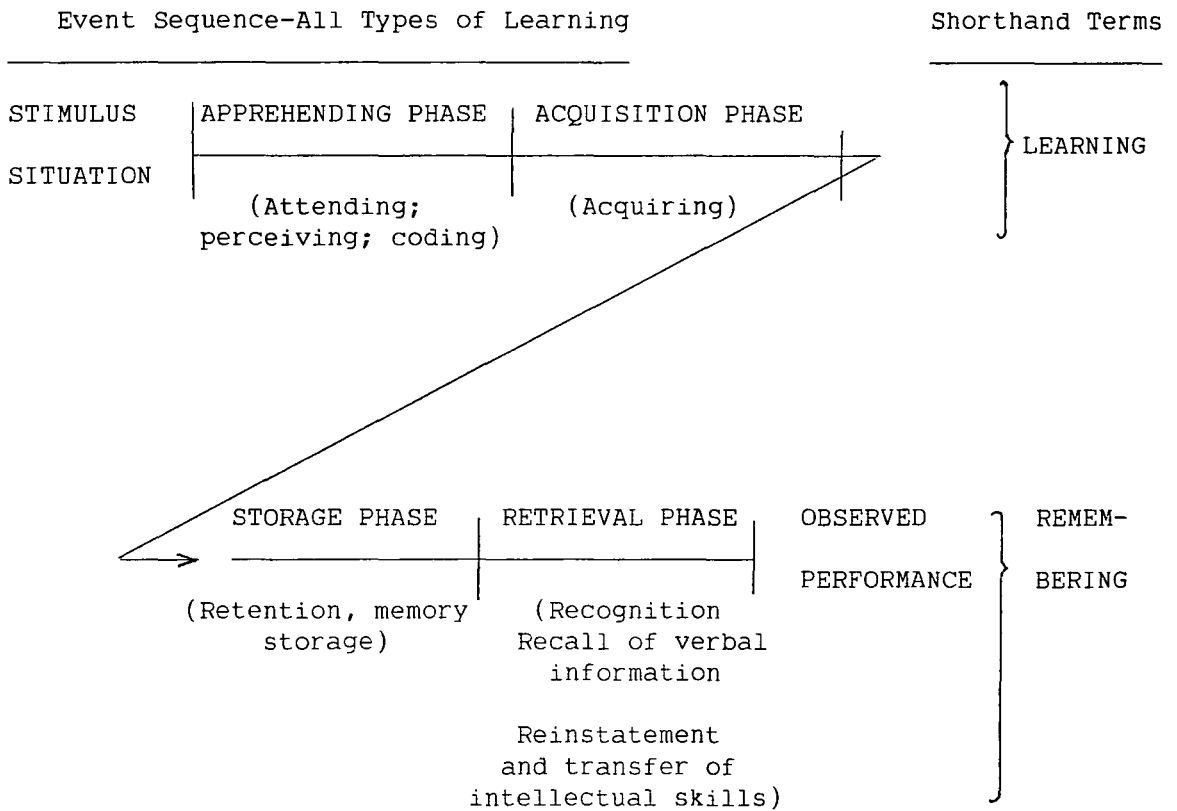
Gagne (1970) proceeds to indentify four phases of the sequence of events in the process of learning. Figure 2.2.1 distinguishes the major portions of a total learning occurrence for all eight types of learning specified by Gagne and outlined below.

1- *Ibid.*, pp. 216-217.

2- *Ibid.*, pp. 222-223.

FIG. 2.2.1

The Sequence of Events in Learning



Source: *Ibid.*, p. 71.

When the stimulus situation is presented, it is followed by an interval of time during which the stimulation is *apprehended*. The *acquisition* phase, in which the changes in the central nervous system underlying the new capability take place, follows. This is followed by the *storage* phase, which refers to some internal activity that "puts into memory store" the newly learned entity, so that it can be retained over a period of time. The *retrieval* phase alludes to the recovery and exhibition of the learned capabilities that have been learned and stored. These two processes of recovery and

exhibition are performed to an external observer through remembering as outcome of the process of learning. According to Gagne, intellectual accomplishment passes through eight hierarchical chains, or sequential stages seen as nested tasks and not as Piagetian stages of growth.(1) Each new step is dependent upon the relevant material learned at the preceding level, which involves the assumption that the child can learn if he is taught supordinate rules first.(2) These herarchical networks develop from the simplest to the most complex. Complex tasks cannot be solved successfully unless the individvual acquires and understands the simple basic ideas of their constituting parts which lead to the more complex whole. Any task can be analyzed step by step so that the individual may reach the final step through the acquisition of the content of knowledge at the preceding steps. E. A. Lunzer (1969) identifies Gagne's (1966) classifications of the chaining of successive cues as 'a higher learning structure arising out of instrumental learning proper'.(3) Gagne's analysis of hierarchicals of learning is shown in figure 2.2.2, and illustrated by an example of solving a physical problem in figure 2.2.3.

- 1- J. Biggs, "The Relationship between Developmental Level and the Quality of School Learning", in S. and C. Modgil, *Toward a Theory of Psychological Development*, p. 627.
- 2- Barry Zimmerman, "Social Learning Theory : A Contextualist Account of Cognitive Functioning", in C. J. Brainerd, *Recent Advances in Cognitive-Developmental Theory : Progress in Cognitive Development Research*, Springer-Verlag, New York, 1983, p. 30.
- 3- E. A. Lunzer, *The Regulation of Behaviour*, Staples Press, London, 1969, p. 198.

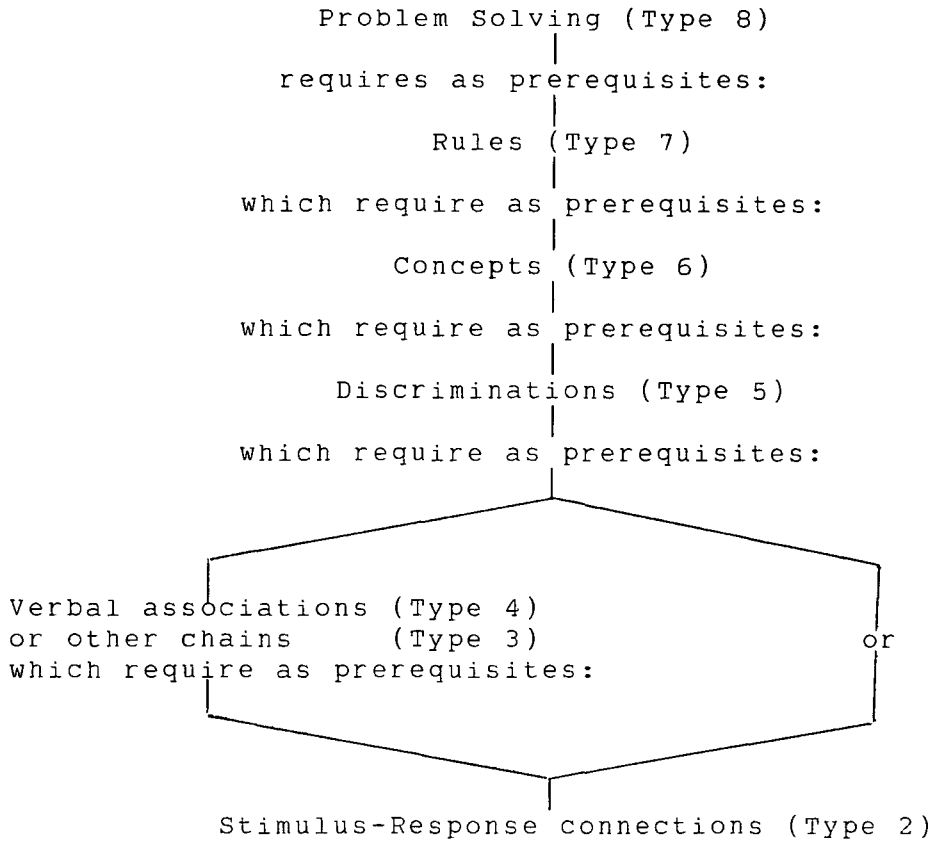


Fig. 2.2.2

Source: Gagne *Op.Cit.*, p. 66.

Gagne (1966, 1970) identifies four kinds of individual differences that may affect the problem solving process as the top of the hierarchial ladder of learning. These are:

First, it appears that a solution is more likely to be achieved rapidly depending on the *store of rules* the individual has available. The person who has a greater variety of rules on which to draw- some of which turn out to be relevant to the problem- will have a greater chance of arriving at a solution. Secondly, individuals may vary in the *ease of recall* of relevant rules. Thirdly, there may be differences in *concept distinctiveness* among

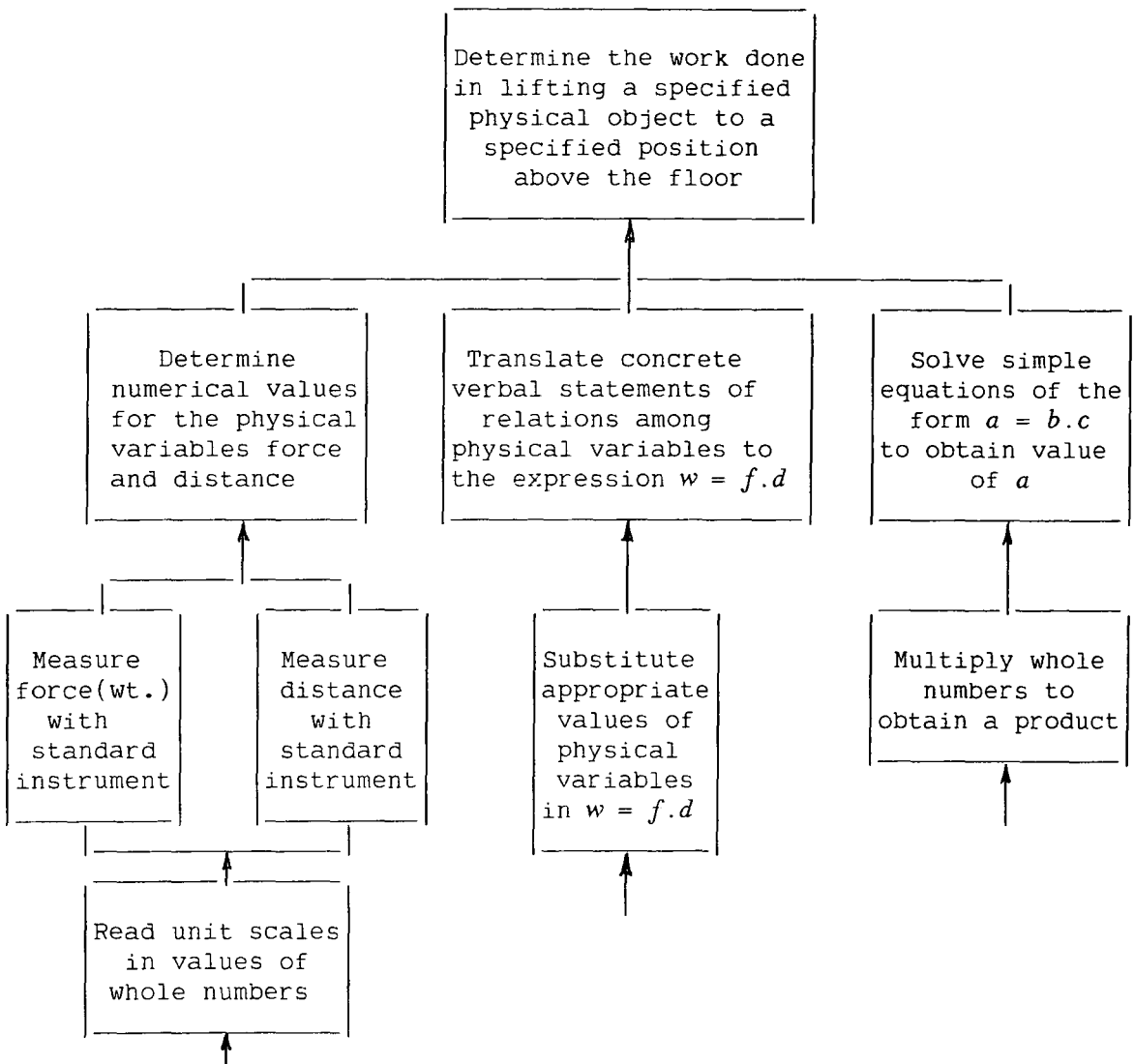


Fig. 2.2.3
Solving physical work problems: a learning
hierarchy pertaining to a science topic

Source: Gagne *Ibid.* p. 263.

individuals, making it possible for one to distinguish relevant aspects of the stimulus situation and thus to "define the problem" more readily than another. Fourthly, there is the important possibility that the *fluency of hypotheses* may distinguish one individual from another on the basis of the facility with which rules are combined into hypotheses.(1)

1- *Ibid.*, p. 223.

2.2.3 A BRIEF ACCOUNT OF AUSUBEL'S THEORY

In principle, David Ausubel's (1968) theory of knowledge comes closer to Gagne's conditions of learning than to Piaget's theory of cognitive development. Nevertheless, there are some points of convergence between the Piagetian and Ausubelian theories, especially at the stage of formal operations. To begin with, Ausubel (1968) strongly advocates that 'The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly'.(1) At the heart of this apparently simple statement, which opens Ausubel's book as his overarching motto, lies the core of his theory of knowledge.(2)

Inconsistent with Piaget's emphasis on activity as an essential and effective factor in the child's cognitive development, Ausubel's statement, when explained, suggests that activity is not so essential in the process of learning as the usage of verbal methods which are much quicker than any other method. Cognitive development, according to Ausubel (1968) does not depend on stages but on the framework of specific concepts and integration between these concepts acquired during the active life-span of the individual. Upon this assumption 'developmental stages imply nothing more than identifiable

- 1- David Ausubel, *Educational Psychology: A Cognitive View*, Holt, Rinehart and Winston, Inc., New York, 1968, p. vi.
- 2- J. Novak, "An Alternative to Piagetian Psychology for Science and Mathematics Education", *Studies in Science Education*, vol. 5, 1978, p. 4.

sequential phases in an orderly progression of development that are *qualitatively* discriminable from adjacent phases and generally characteristic of most members of a broadly defined age range'.(1) Moreover, Ausubel (1968) specifies seven major constituting concepts of his theory of cognitive development.

1- Meaningful Learning:

Ausubel (1968, 1978) differentiates between rote in the meaningful learning and between reception and discovery learning. In meaningful learning process the learner is consciously able to relate new ideas in a nonarbitrary and substantive way to some *specifically relevant existing aspect* of the learner's cognitive structure. Whereas rote learning implies arbitrary memorization and verbatim incorporation of new material into the learner's structure of knowledge.(2) On the other hand reception learning implies that the learned material is presented to the learner in final form which does not need any independent effort on the learner's part. In contrast discovery learning involves that the learned material is not given but it must be discovered by the learner before it can be meaningfully incorporated into the learner's cognitive structure (Fig. 2.2.4).

Ausubel identifies three conditions for meaningful learning to take place:

1- Ausubel, *Op.Cit.*, p. 193.

2- Ausubel et al, *Educational Psychology: A Cognitive View*, Holt, Rinehart and Wiston, Inc., New York, 1978, p. 41.

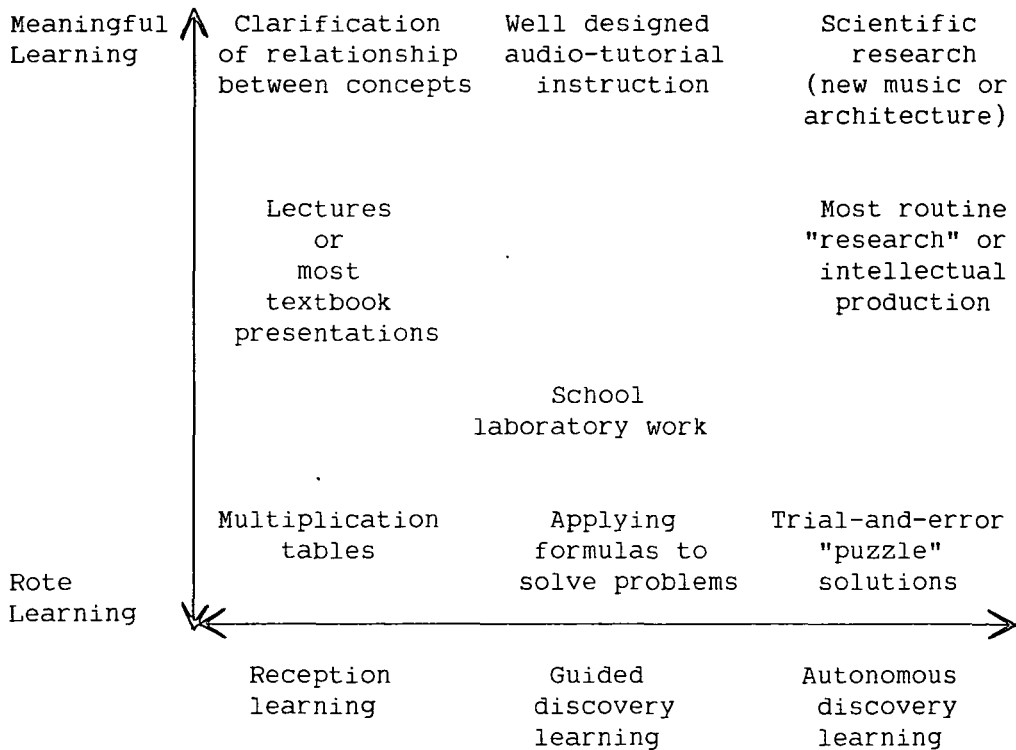


Fig. 2.2.4

Reception learning and discovery learning are on a separate continuum from rote learning and meaningful learning

Source: Ausubel (1978) p. 25.

- A- The learning material itself must be nonarbitrary in the sense that it must be plausible, meaningful and substantive - this does not mean that it has to be true since something untrue can be learned meaningfully.(1)
- B- The learner's cognitive structure must contain relevant knowledge to which the new material can be related.
- C- The learner must manifest a disposition to relate the new material nonarbitrarily and substantively to his cognitive structure.(2)

- 1- J. Maclelland, "Ausubel's Theory of Learning and Its Application to Introductory Science", In B. Hudgson and E. Scanlon, *Approaching Primary Science*, Harper and Row, Publishers, London, 1985, p. 136.
- 2- Ausubel (1978), pp. 38-41.

2- *Subsumption*:

According to Ausubel the concept of subsumption constitutes the governing principle in the process of storage and retrieval of verbal knowledge. Through subsumption a newly presented material is meaningfully incorporated into and integrated with the learner's previously learned structure of knowledge. Novak (1978) maintains that Ausubel's concept of subsumption is different from Piaget concept of assimilation in that (a) new knowledge is linked to *specifically* relevant concepts or propositions and (b) this process is continuous and major changes in meaningful learning (or use of knowledge in problem solving) occur not as a result of general *stages* of cognitive development but rather as a result of growing differentiation and integration of specifically relevant concept in cognitive structure.(1)

3- *Obliterative Subsumption or Memorial Reduction*:

Newly acquired items of information are usually affected by the degree of stability of the organized structure. Although meaningfully learned ideas can be retained for a long period, they are at the same time liable to a mechanism for subsequent forgetting through which their details may be lost. But the loss of their details paves the way for new relevant meaningful learning to be assimilated in relation to them. When this " *obliterative* stage of assimilation begins, the new

ideas become spontaneously and progressively less dissociable from their anchoring ideas as entities in their own right, until they are no longer available and are said to be forgotten".(1) An individual may forget the formula for Ohm's law and still recall that there is a definite relationship between voltage, current and resistance. Here forgetting serves as a continuation of the same assimilative process underlying the availability of newly learned ideas about electricity. Thus the process of memorial reduction "represents a progressive loss in the dissociability of newly-assimilated ideas from the ideational matrix in which they are imbedded and in relation to which their meaning emerges".(2)

4- Progressive Differentiation:

This is an integral part of Ausubel's theory of assimilation. It means that when new knowledge is acquired, the most general and inclusive ideas are presented first. Then they become elaborately and progressively differentiated in terms of detail and specificity through the formation of new linkages which modify the whole discipline of interrelated concepts into which the new propositions may be subsumed. In this respect Novak (1978) points out that any given concept is never 'acquired' but rather in the process of being differentiated. It is, therefore, due to the qualitative differences among individuals in the degree of

1- Ausubel, (1968), p. 93.

2- *Ibid.*, p. 94.

differentiation of specifically relevant segments of cognitive structure that "some adults attack new learning or problem solving with the naivety of children, and ... some children think like adults in some instances".(1)

5- *Superordinate Learning:*

Meaningful new ideas or concepts are learned by being subsumed in a preexisting learned structure of concepts. The opposite may occur when an inclusive new concept is introduced. In this case it is the new concept that subsumes the relevant aspects of already established cognitive structure. In other words when a new idea is subordinate to the more inclusive structure, the subsumption is called 'derivative'; when the new item is coordinate with the pre-existing structure, the subsumption is called 'correlative'; but when the presented new material implies the previously acquired synthesis of component ideas, the subsumptive learning is described as superordinate. For instance, superordinate learning takes place when the learner knows that dogs, cats, people, etc. are all forms of *mammals*.

6- *Integrative Reconciliation:*

It is the recombination of existing elements of cognitive structure and it is closely connected to superordinate learning. It takes place when concepts and propositions which were perviously conceived as distinct

or even inconsistent are modified and integrated into new meanings. It involves the sorting out of what seems to be confusing, and the resolving of what may appear to be conflicts between concepts with the aid of a teacher or instructional materials. For example, students may know peas or tomatoes as vegetables, but these are classified as fruits in biology. The initial confusion a student may experience is resolved when new combinatorial meanings are learned and the student recognizes that the nutritional classification of foods is not the same as the botanical classification. Thus carrots, beets, and yams are vegetables and plant roots, but peas, cucumbers, and tomatoes are vegetables and plant fruits.

7- *Advance Organizers:*

According to Ausubel advance organizers involve the use of appropriately relevant and inclusive introductory materials (introduced in advance of the learning material itself). They should be absolutely clear and stable to facilitate establishing the learning of meaningful verbal material and to enable the learner to relate elements of new materials to specifically relevant aspects of existing cognitive structure. Thus the basic function of organizers is "to *bridge the gap* between what the learner *already knows* and what he *needs to know* before he can meaningfully learn the task at hand".(1).

CHAPTER THREE

AN INVESTIGATION OF ANIMISM (REVIEW OF LITERATURE)

To every natural form, rock, fruit, or flower,
Even the loose stones that cover the highway,
I gave a moral life: I saw them feel,
Or linked them to some feeling: the great mass
Lay bedded in a quickening soul ...

(Wordsworth, *The Prelude*)

* * * * *

3.1 INTRODUCTION TO THE PROBLEM

Piaget's study of animism(1929) has given rise to widely controversial points of view among those who are concerned with the subject. In his literature of the child's conception of the world, Piaget defines animism as the tendency of the child to attribute life and consciousness to a large number of inert objects.(1) As well as the conclusions Piaget obtained from his investigation and interviews with children, this doctrine of animism has been based on two main hypotheses: first, Piaget believes that because of the child's egocentricity he cannot discriminate his physical world from his psychical world. The second hypothesis is that the child does not realise any distinct limits between his own self and the outside world in the early stages of his development to the extent that he regards his own point of view as absolute and is the centre of the world. Piaget and Inhelder (1963) describe this as "false absolute".(2)

3.1.1 STAGES OF ANIMISM

Piaget has divided the spontaneous development of the animistic thinking in the child into four successive stages according to the characteristics each stage reveals. The first stage lasts on an average of 5-6 years during which the child ascribes the life of an object to

- 1- J. Piaget, *The Child's Conception of the World*, Routledge & Kegan Paul Ltd., London, 1929, p. 169.
- 2- *The Child's Conception of Space*, p. 194.

its active condition, that is to say a candle is alive while it gives light and it is dead in its inert condition, and a mountain is not alive because 'it does not do anything'. In this stage, in the child's thinking the word "alive" means "to do something" or "to be able to move". In short, the concept of life is assigned to activity in general, and to activity that is helpful or useful to man in particular.

The second stage is transitional in the sense that the word "life" is usually ascribed by the child to anything that moves. For instance, the sun is alive merely because it always moves while the moon is not alive because it 'always stays in the same place'. The average ages of this stage are 6 to 8 years. In the third stage, which lasts on the average between 8-9 and 11-12 years, the child tends to attribute life to anything that moves spontaneously, that is to say, with no assistance from without; therefore, a bicycle is not alive because it is a man who makes it go, and a lake is not alive either because it cannot move by itself, whereas fire, the sun, the stars, and the clouds are believed to be alive because they move spontaneously and without external help.

In the fourth stage, which is the most mature level of the child's conceptual development of 'life', the child ascribes life to animals and plants, although sometimes he restricts it to animals alone. However, the child in this stage is capable of differentiating his subjective world

from the external world.

Piaget (1933) subsequently gave a more definite age-average of the four stages of the child's animistic development; the first stage lies between four and six years, the second stage ranges from 6 to 7 years, the third from 8 to 10 and the fourth happens at about eleven years.(1) The division of the four stages of the animistic thinking in the child's development of the concept of life concluded by Piaget was the result of conducting what he called the "clinical method" of studying the child's thought content. In this technique the experimenter interviewed the child by questioning him and making an attempt to pursue his reasoning. The following examples are illustrations of the technique utilised by Piaget on each stage:

Vel (8;6): "Is the sun alive? - *Yes*. - Why? - *It gives light*. - Is a candle alive? - *No*. - Why not? - (*Yes*) *because it gives light. It is alive when it is giving light, but it isn't alive when it is not giving light*. - Is an oven alive? - *Yes, it cooks the dinner and the tea and the supper*. - Is a gun alive? - *Yes, it shoots*. Vel even goes so far as to say that poison is alive - "*because it can kill us*". (2)

According to Piaget, the responses of Vel in the example above quoted were classified as belonging to the characteristic of the first stage of animism although the child was 8 years and six months old, for the child

1- Piaget, "Children's philosophies", in *A Handbook of Child Psychology*, ed. by C. Murchison, 1933, pp. 537-538.

2- *The Child's Conception of the World*, p.196.

attributed life to "the sun" and "the gun" because of their "usefulness and activity in general". The following is an example of the second stage:

Zimm (8;1): Is a stone alive? - *Yes*. - Why? - *It moves* [il marchel]. - When does it move? - *Some days, sometimes*. - How does it move? - *By rolling*. - Is the table alive? - *No, it can't move*. - ... Is the lake alive? - *Yes, it moves*. - Always? - *Yes*. - Is a bicycle alive? - *Yes*. - Why? - *It goes* [elle marchel], etc.(1)

It is obviously concluded from that example that the child attributed life to "things which move", and as a result Zimm was classified under the second stage. In the following example the child showed the characteristic of the third stage in animistic development by ascribing life only to "things which move spontaneously":

Sart (12;6): You know what it means to be alive? - *Yes*. - Is a fly alive? - *Yes*. - Why? - *Because if it wasn't alive it couldn't fly*. - Is a bicycle alive? - *No*. - Why not? - *Because it is we who make it go*. - Is a horse alive? - *Yes*. - Why? - *He helps man*. - Are streams alive? - *Yes, because the water is flowing all the time*. (2)

As indicated above, the child in the fourth stage attributes life only to "plants and animals". This restriction of life to plants and animals is clearly shown in the following example:

Cel (10;7) denies consciousness even to the sun and the moon "*because it is not alive*". "What things can know and feel? - *Plants, animals, people, insects*. - Is that all? - *Yes*. - Can the

1- *Ibid.*, p. 199.

2- *Ibid.*, p. 202.

wind feel? - No, etc.(1)

3.1.2 REALISM:

It is appropriate in this connection to illustrate the fact that Piaget in his book, *The Child's Conception of the World* (1929) differentiates between three forms of the child's intellectual tendency owing to his inability to discriminate between himself and the world, which arises from his egocentric thought. These three forms are: *realism* in which the child tends to make concrete abstract ideas and psychological phenomena such as thoughts, names, and dreams; *animism* in which, as has been mentioned before, the child has the tendency to ascribe life or its attributes to inanimate objects; and thirdly *artificialism* in which the child tends to interpret natural and physical phenomena as humanly or sometimes supernaturally created or caused.

Although the present chapter is not to be extended to the three Piagetian forms and is confined only to animism, the other two forms must be briefly referred to on the basis that the three forms are characteristic of the undifferentiation by the child between himself and the world in his cognitive development as professed by Piaget.

1- *Ibid.*, p. 187.

To sum up, Piaget classifies three distinct stages of the child's conceptions of dreams. The following is an example of the form realism applied experimentally to thoughts and names:

During the first (approximately 5-6) the child believes the dream to come from outside and to take place within the room and he thus dreams with the eyes. Also, the dream is highly emotional: dreams often come "to pay us out", "because we've done something we ought not to have done", etc. During the second stage (average age 7-8) the child supposes the source of the dream to be in the head, in thought, in the voice, etc., but the dream is in the room, in front of him. Dreaming is with the eyes; it is looking at a picture outside. The fact that it is outside does not mean that it is true: the dream is unreal, but consists in an image existing outside, just as the image of an ogre may exist, without there actually being a real ogre. Finally, during the third stage (about 9-10), the dream is the product of thought, it takes place inside the head (or in the eyes), and dreaming is by means of thought or else with the eyes, used internally.(1)

Regarding the realism of thought, Piaget believes the first stage to be characterised by the child thinking that thought is connected with the movement of the mouth in the sense that "people think when they talk and stop thinking when their mouths are shut".(2) Although the second and third stage are classified together as the child's understanding of thought as with the head, "the characteristic of the second stage as opposed to the third is that thought, although situated in the head, remains

- 1- *Ibid.*, pp. 90-91.
2- *Ibid.*, p. 39.

material".(1) The same conclusion can be applied to the "nominal realism" of the child's intellectual development observed and elucidated by Piaget: "During the first stage (5-6) the child supposes that we came to know the names of things simply by looking at them. We need only to look at the sun to know it is called "sun". During the second stage (7-8) the child claims that God told us the names of things. During a third stage (9-10) the child finally realises that names have been handed down from father to son since the time they were invented".(2) But as a whole, Piaget concludes that there is a "complete parallelism between the child's conceptions of names and of thought and its conceptions concerning dreams".(3)

In the artificialism studies, Piaget classifies four stages in the child's development of the conception of night. During the first stage the child explains night in pure and complete artificial terms, but without saying "how it is made". While in the second and third stages the child explains night as being half artificial and half physical: "night is a great black cloud, moved by human powers, and which fills the whole atmosphere (second stage), or which simply blocks out the day (third stage)".(4) In the fourth stage night is believed to come from the disappearance of the sun.

- 1- *Ibid.*, p. 49.
- 2- *Ibid.*, p. 68.
- 3- *Ibid.*, pp. 121-122.
- 4- *Ibid.*, p. 291.

3.2 INVESTIGATION OF THE CHILD'S ANIMISM

In fact, these four stages of the Piagetian theory of the child's animism together with Piaget's claim of their universality paved the way for an increasing number of studies and investigations in the field (e.g. Mead, 1932; Huang, 1943; Huang, Yang and Yao, 1945; Huang and Lee, 1945; Russell, 1939, 1940a, 1940b, and 1942; Russell and Dennis, 1939, 1941; Dennis, 1942, 1943; Klingensmith, 1953; Nass, 1956; Klingberg, 1957; Jahoda, 1958a, 1958b; Mogar, 1960; King, 1961; Laurendeau and Pinard, 1962; Whiteman, 1967; Smith and Dougherty, 1965; Looft and Bartz, 1969; Looft and Charles, 1969; Looft, 1973, 1974; Mikulak, 1970; Papalia and Bielby, 1974; Berzonsky, 1970, 1971b and 1974; Siegler and Richards, 1983; Bullock, 1985; and others).

Owing to the various techniques and different approaches used by workers to the problem posed by Piaget's theory of animism, their researches and studies have come to many different, sometimes conflicting, conclusions. Consequently, they have varied in their evaluation of Piaget himself.

3.2.1. ANIMISM VERIFIED

The existence of the four stages of animism as defined by Piaget was verified through a series of studies undertaken by Russell (1939, 1940a, 1940b, and 1942), by

Russell and Dennis (1939, 1941), and by Dennis and Russell (1940). In their study, Russell and Dennis (1939) examined 385 subjects ranging from the nursery school to the eighth grade, and a week later they re-examined 133 subjects by the same method. The subjects were asked if objects such as stone, grass, dog, bird, pencil, and the moon were alive. They agreed with the classification of children into the four stages of animism defined by Piaget because 'On the first examination all but four and on the re-examination all but two of the subjects who showed evidence of clear-cut concepts fell into the four stages of animism'.(1) The same conclusion was confirmed in all Russell's studies. For instance, Russell (1940b) literally repeated that, from the results obtained, classification into stages exactly analogous to the stages of animism was possible.(2)

In a supplementary investigation, Dennis and Russell tested a small group of 24 Zuni children on whether a battery of objects was alive or dead. The results obtained revealed that about 80 per cent of the subjects responded in terms of animistic thought.(3) In their defence of the standardized procedure offered in Russell

- 1- R.W. Russell and W. Dennis, "Studies in animism: I.A standardized procedure for the investigation of animism". *Journal of Genetic Psychology*, 1939, 55, p. 400.
- 2- Russell, "Studies in animism:IV. An Investigation of concept allied to animism", *Journal of Genetic Psychology*, 1940b, 57, p. 83.
- 3- W. Dennis and R. Russell, "Piaget's questions applied to Zuni children", *Child Development*, 1940, 11, 181-187.

and Dennis (1939), Russell and Dennis (1941) conducted another investigation on 92 children to determine whether their preliminary remarks were suggestive or not. The subjects were examined without using the preliminary remarks utilized in previous studies: "We are going to play a game. I am going to ask you some questions and we will see how many you can answer. You know what 'Living' means? A cat is living but if an automobile runs over it, it is dead".(1) Russell and Dennis found that responses to some situations indicated that using the preliminary remarks provided the child's responses with more rapidity and more freedom than omitting them. Hence, the investigators came to the conclusion that these preliminary remarks were not suggestive in themselves, but rather enabled the child to be acquainted with the nature of the question to follow.(2)

Furthermore, Dennis (1942) conducted a study on his own daughter so as to find out whether Piaget's theory of realism, especially the conceptions of dreams and names, could be observed in the primary stages of his daughter's cognitive development or not. The child was asked questions taken from various sections of Piaget, *The Child's Conception of the World*, throughout the age range 2 years and 9 months to 6 years and 2 months. Dennis observed that his daughter's development was in complete

- 1- R. W. Russell and W. Dennis, 'Note concerning the Procedure employed in investigating child Animism', *Journal of Genetic Psychology*, 1941, 58, p. 423.
- 2- Ibid., p. 424.

agreement with the child's sequences of abstract ideas designated by Piaget. Dennis's conclusion was primarily based on the assumption that her answers were autogenous developing from her own experience and her own reaction tendencies. At the same time he rejected the idea that his daughter's answers were transmitted by adults.(1)

Following this, Dennis (1943) came to the same conclusion when he conducted a study on 98 American Indian children.(2) Judging from the results, Dennis claimed that the uniformity of children's earliest ideas in all societies was a result of the universality of their experiences and mental immaturity.

In another study, Russell, Dennis, and Ash (1940) were interested in investigating the effects of experience on the development of animistic thinking in those then designated as feeble-minded subjects (now referred to as "subnormal"). The sample consisted of 430 subjects taken from two areas: Virginia, with a range in mental age from 2 years 11 months to 11 years 7 months and in chronological age from 8 years 0 month to 64 years 10 months, and Wrentham, ranging from 4-10 years in mental age and from 7 years and 2 months to 20 years 10 months in chronological age. By making comparison between the

- 1- W. Dennis, 'Piaget's questions applied to a child of Known environment', *Journal of Genetic Psychology*, 1942, 60, pp. 319-20.
- 2- W. Dennis, "Animism and related tendencies in Hopi children", *Journal of Abnormal and Social Psychology*, 1943, 38, pp. 21-36.

results obtained from the subnormal subjects with other results given by normal children of the same mental age, Russell, Dennis, and Ash hypothesised the existence of the influence of additional years of experience on the animistic thinking if mental age is held constant. As a result they found that the subnormal adults were more advanced compared to the normal children of the same mental age although the subnormal adults' ideas of animation were nearer to the children's than to the normal adults' ideas.(1). As a whole the results of the study conducted by Russell et al strongly corroborated Piaget's stages of animism since almost the whole sample, with the exception of five subjects of the subnormal group, were classified into the four Piagetian stages of animism. On the same level, Russell (1942) in another study investigating animism in older children observed that only 11 out of the 611 subjects participating in his investigation had systematic distinctions between the animate and inanimate objects tested. Above all, there was a clear rise in the percentage of children at the adult stage (stage 4) of concept development accompanying progressive increases in mental and chronological age.(2)

- 1- R. W. Russell, W.Dennis & F.E. Ash, "Studies in animism: III. Animism in Feeble-minded subject, *Journal of Genetic Psychology*, 1940, 57, p. 63.
- 2- R.W. Russell, 'Studies in animism:V. Animism in older children', *Journal of Genetic Psychology*, 1942, 60, p. 334.

Myrtle Bruce (1941) found clear evidence of animistic thinking in the child during the gradual development of the concept "alive". Bruce applied a questionnaire that was based on Piaget's work to a group of White and Negro children in Southern Virginia. Before asking the child the same questions used by Piaget, Bruce made clear the child's concept of the term "alive" by having the child attempt to formulate his concept of the term. By this process Bruce observed the child's hazy and often confused meaning for the term "alive". In her unstandardized procedure, Bruce asked the child, "What does the word alive mean?". In the case of a child's inability to answer he was asked "Are we alive?", the same question then being applied to trees, the sun, clouds, car and so on. The results of her study did not reveal any significant differences between the Whites and Negroes concerning the concept of animism, but rather supported Piaget's finding of the four stages of animism in both White and Negro groups.(1)

In the light of Piaget's developmental stages of the child's animism and their strict parallelism with Nagy's (1948) stages of life and death conceptions, Safier (1964) conducted an investigation to determine whether or not there was a relationship between the formations of the concepts of life and death in children. Three groups of boys aged 4-5, 7-8, and 10-11 years took part in the

1- Myrtle Bruce, 'Animism vs. evolution of the concept "alive"', *Journal of Psychology*, 1941, 12, pp. 81-90.

study. Safier concluded that the results obtained substantiated both Piaget's and Nagy's findings.

As far as Piaget's stages of animism were concerned, the subjects of the first group showed implicit and integral animism, classified by Piaget as characteristic of the first stage, Piaget's second stage was clearly identified in the second group, while the boys in the third group were moving toward synthesizing the concept of life and death by adult criteria.(1) Moreover, Safier, as a result, suggested that Huang and Lee (1945) imputed the child's difference in thinking from the adult only to his lack of information about the "real" world because they had denied any special type of childish logic that would lead to different types of animism. For this reason, Safier called Huang and Lee's theory a "computer theory" on her assumption that the computer can give correct answers only to the extent that it has the correct amount of data fed into it. For example, the child thinks about a stone as being alive because he has not been taught otherwise. One can characterize Piaget's theory of animism as a "stage-development theory."(2)

As discussed in the second chapter, Piaget had referred to the role of language in concept development.(3) Bruner (1964) too confirmed the increasingly powerful role played

1- G. Safier, "A study in relationships between the life and death concepts in children", *Journal of Genetic Psychology*, 1964, 105, pp. 292-293.

2- Ibid., p. 284.

3- See above pp. 40-1.

by language in the process of the cognitive development in children between 4-12 years. Through simple experiments, Bruner made an attempt to investigate and prove how language shapes, augments, and even supercedes the child's earlier modes of processing information. He found that the child's "translation of experience into symbolic form, with its attendant means of achieving remote reference, transformation, and combination, opens up realms of intellectual possibility that are orders of magnitude beyond the most powerful image forming system." (1)

3.2.2 ANIMISM DISPUTED

Huang and Lee (1945) in their study administered on children of the first and second stages, objected to Piaget's doctrine of the "alleged universal tendency in children to regard all things as alive and [endowed with will]". (2) Their objection was mainly built on two reasons. First, the child may find it difficult to understand the meaning of the word "living", therefore, he ascribes animism to an inanimate object. The second reason is that even in the case of making such a mistake as attributing life to an inanimate thing, it is not as much due to an animistic attitude of the child's mind as to his lack of familiarity with the traits of the object

- 1- Jerome S. Bruner, 'The Course of Cognitive Growth', *American Psychologist*, 1964, 19, pp. 13-14.
- 2- I. Huang and H. W. Lee, 'Experimental analysis of child animism', *Journal of Genetic Psychology*, 1945, 66, p. 69.

in question. For this reason 'knowledge about traits is in general more advanced than judgment regarding animation'.(1) In Huang and Lee's study 40 children ranging in age from 3 years 5 months to 8 years 7 months were asked seven questions about ten objects. The first two questions, concerning the problem of "animation", were: 'Was it living?' and 'Did it have life?' They concluded that animism is not general, but based on limited knowledge about certain objects.

On the basis and conclusions of the above mentioned study of Huang and Lee (1945) along with the general review of the literature on animism in children made by Huang (1943)(2), Strauss (1951) made an attempt to re-examine the data obtained by Huang and Lee. Strauss summarised the conclusion of Huang (1943) stating that the investigations did not substantiate Piaget's finding of the universality of animistic thought and that Huang attributed the animate-inanimate dichotomy to incomplete differentiation rather than to a universal animistic cast of mind. After re-examining the data given by Huang and Lee, Strauss concluded that the Huang-Lee study and data did not solve the problem of animism at all, but sharpened it. Moreover, the re-examination indicated that the data were "open to interpretations much different than those originally drawn. The data question can, then be raised

1- Ibid., p. 73.

2- I. Huang, "Children's conception of physical causality : A critical summary", *Journal of Genetic Psychology*, 1943, 63, pp. 71-121.

whether indeed the Chinese data supports either Piaget's or Huang's hypothesis. The data are not in themselves a decisive test, as the authors seem to believe they are, and as casual reading of the article would lead one to suppose".(1)

On the same level of repudiation was Margaret Mead's pioneer study (1932) conducted in the years 1928-29 among the Manus people of the Admiralty Islands. Mead refuted Piaget's theory of animism on the ground that the child's attribution of animism to inanimate objects was due to cultural, educational and environmental influences and not to the structure of the child's thought, and therefore, 'Animistic thought cannot be explained in terms of intellectual immaturity'.(2) Mead assessed the degree of animism in the primitive(3) children of the Manus tribe in order to determine whether the animistic thought in the child's mind was different in degree and kind from that of the adult and therefore was more closely related to the thought of the "savage" than to the thought of the civilized and educated, or whether the reason for the disappearance of animistic thought in adults of a civilized society was due to education or to a

- 1- Anselm L. Strauss, "The Animism Controversy: Re-Examination of Huang-Lee Data", *The Journal of Genetic Psychology*, 1951, 78, p. 112.
- 2- Margaret Mead, "An investigation of the thought of primitive children, with special reference to animism", *Journal of the Royal Anthropological Institute*, 1932, 62, p. 189.
- 3- The word primitive used by Mead refers to those people who are completely without a written tradition, (Ibid., p. 174.).

developmental process. Her sample consisted of 41 children aged approximately from 2 to 12 years; 22 children aged 2-6 years, and 19 aged 6-12 years. Mead used directly experimental methods which were as follows:-

- (a) Observation of a group of children, or of a child and an adult, or a group of children and adults, etc., in some ordinary social situation.
- (b) Collection of spontaneous drawings.
- (c) Interpretation of ink blots.
- (d) Definite stimuli in the form of question designed to provoke animistic responses.

Mead's results of the first category indicated that there was no evidence for spontaneous animistic thought and even when the Manus child attributed events to ghosts he expressed a common feature of adult behaviour and the same if he called a pig by name, but if he addressed a dog, he thought in spontaneous animism because Manus do not name dogs or speak to them in words. Viewed in that light, Mead found no instance of 'a child's personalizing a dog or a fish or a bird, of his personalizing the sun, the moon, the wind or the stars'.(1) As far as the second category is concerned, there was no tendency to personalize animals and natural phenomena or to humanize inanimate things in the Manus children's drawings and as a result the first category was confirmed by the second. As regards the third category, the ink blot also provided no

1- Ibid., p. 181.

indication of a tendency to spontaneous animism on the part of the children. Even when the children were questioned by introducing them to some designed situations, they did not give any evidence of animistic thought or magical explanations in any of the six definite stimuli presented as follows:-

- (1) The attribution of malicious intent to a canoe which had drifted away. The stimulus question, "That canoe is bad, isn't it? It has drifted away."
- (2) The glass chimes.
- (3) The dancing doll.
- (4) The attribution of malicious intent to the pencil.
- (5) The typewriter.
- (6) The Japanese paper flowers.

They rejected the explanation that the canoe was bad and attributed its drifting away to bad fastening. They refused to blame the pencil for their bad drawings and gave reasoned explanations for the other situations. Consequently, Mead came full circle to the opposite conclusion, that animistic thinking is not a universal phenomena in the child's mind and the lack of animism in the Manus children's explanations was due to the peculiar educational encouragement: 'Children are taught early and painstakingly how to walk, swim, climb, handle a canoe,

shoot a bow and arrow, and throw a spear accurately.(1)

3.3 MAGICAL THINKING AND A VARIETY OF TECHNIQUE

Piaget (1929), as well as Inhelder and Piaget (1958) relying on Piaget's (1929) earlier observations, also maintained the idea of the mutual relation between magical thinking of the child and animism in explaining the various phenomena of the natural world. He found that children of the ages 7-8 generally attributed the movement of the sun and moon to the air, the wind, the clouds, etc., but at the same time they thought that the sun and the moon 'follow us', 'watch over us' or 'walk with us', which implied a 'magico-animistic factor' in the child's conceptions(2), or as Sohan and Celia Modgil (1976) put it 'the child has powers to make things happen or prevent things from happening by his own (magical) powers'.(3)

In later stages the child demonstrates what Piaget calls 'artificialism' in which the child ascribes the causality of a phenomenon to external forces such as powerful men, spirits or God. In one of the examples Piaget gives, the child was asked 'Why does the sun move?'. The child answered that the sun moves *because something pushes it*. Is it inside or outside, this

1- Ibid., p. 188.

2- *The Child's Conception of the World*, pp. 215-222.

3- Sohan and Celia Modgil, *Piagetian Research: Compilation and Commentary*, NFER Publishing Company Ltd., London, 1976, Vol. 2, p. 75.

something? - *Inside* - What is it? - *It is God*. (1)

In this respect, Berzonsky's findings (1971b), as well as Nass's (1956), are incongruous with Piaget's theory of the child's resort to magical explanation of the causality of natural phenomena. While Berzonsky lays stress on the importance of familiarity with the objects or events asked about as an influential element in getting the child's responses, Nass emphasises the importance of the form of the question as a decisive factor in obtaining magical or non-magical responses.

As regards Nass (1956), he finds that the form of the question results in a difference in the types of the children's responses, and 'questions worded so as to suggest the possible operation of "animistic", "supernatural" or "dynamic" forces yielded more such nonnaturalistic types of responses than questions less suggestively worded'.(2) This idea has been substantiated by the child's responses to the 'how' questions (e.g. How does the radiator get hot?) in more naturalistic explanations than to the 'why' questions (e.g. Why do leaves fall off the trees).(3) In corroboration, Berzonsky (1971b) points to the influence of situational variables such as question forms, testing procedure, and, of course

1- Piaget, *Op.Cit.*, p. 271.

2- M. L. Nass, "The effects of three variables on children's concepts of physical causality", *Journal of Abnormal Social Psychology*, 1956, 53, p. 196.

3- *Ibid.*, p. 194.

familiarity on the types of explanations of natural phenomena given by children.(1)

Smith and Dougherty (1965) indicate that experimentation and demonstrations lead to more naturalistic explanations by children than abstract questions.(2) Furthermore, their findings contradict Piaget's idea of the existence of a definite stage in the child's growth of logical thinking that can characterise a given age on the basis that 'each subject, regardless of age, grade level, or mental ability, gave a wide variety of responses'.(3) The child's range of language, the formulation of the questions and the experimental background are more influential factors on the child's explanations than age-related stages.

Similarly, Klingberg (1957) supported the criticism launched against Piaget by Huang and others concerning the inability of 7 to 10-year-old children to differentiate between living and non-living objects. Nevertheless, Klingberg pointed out that even at the age of 9-10 years the differentiation of certain objects seems difficult for some children to make. In addition, he observed that it was the formulation of the question that resulted in a difference in the children's responses. In other words,

- 1- M. D. Berzonsky, "The role of familiarity in children's explanations of physical causality", *Child Development*, 1971b, 42, p. 714.
- 2- F. Smith and J. H. Dougherty, "Natural phenomena as explained by children", *Journal of Educational Development*, 1965, 59, p. 140.
- 3- Ibid., pp. 137-138.

the question "Has it life?" produced less animistic responses than the question "Is it living?".(1)

In the same spirit, Klingensmith (1953) indicated that the child's difficulty in discriminating between animate and inanimate objects consisted essentially in his misunderstanding of the term 'alive', and not in his misinterpretation of the nature and activity of inanimate objects. In Klingensmith's opinion, the child's statement that a certain object is alive is an inadequate measure of animism. Therefore, he assumes that when the child says: the candle is alive, he seems to have in mind the meaning of 'lively'(2), and not to ascribe sensory and functional attributes to an inanimate object as Piaget seems to have suggested that the child means.(3)

Although King (1961) in his study observed the existence of some animistic responses at all ages questioned, he concluded that movement was not recognised by the children as the only criterion of life(4), and that there was no evidence of the four stages of the Piagetian animistic development, but only 'a gradual development of the reasoning processes by more systematic organisation of

- 1- G. Klingberg, 'The distinction between living and not living among 7-10-year-old children with some remarks concerning the so-called animism controversy', *Journal of Genetic Psychology*, 1957, 90, pp. 234-235.
- 2- S. Klingensmith, 'Child animism: What the child means by "alive"', *Child Development*, 1953, 24, p. 59.
- 3- Ibid., p. 61.
- 4- W.H. King, "The development of scientific concepts in children", *British Journal of Educational Psychology*, 1961, 31, p. 14.

concepts'.(1) In his study, King dealt with the child's animistic thinking in one section of the whole study of the development of scientific concepts which contained five sections. The section on animism was divided into two parts: the first part tested the children's animistic thought by asking "Is the sun alive?" The same form of question was repeated in turn for tree, dog, flower, fire, candle, river, train, boat, aeroplane and bird, then the child had to answer the question "Are all things that move living?" The second part dealt with the child's written responses to five questions such as "What is the sky?" and "What is the night?"

Regarding the age stages of the subjects ranging from 5 to 12 years, 94 per cent of 6-year-old girls stated without difficulty that the dog and the bird were living while 80 per cent of 6-year-old boys performed successfully. Succeeding ages showed a steady increase in response from 98 per cent to 99 per cent respectively. The responses to the boat, aeroplane, river, and train were similar where the majority of 8-12 years (70 per cent to 90 per cent) did not ascribe life to these objects and very few children at all ages showed failure in deciding one way or the other. To some extent the sun and fire replies scored had the same percentage but with more variations between the ages, and between the sexes particularly in the case of fire; 25 per cent of 6 year

1- Ibid., p. 16.

olds decided that the sun was not alive, while the sun was seen to be alive and not alive by 9-year-old children in equal percentages, but 56 per cent of 11 years said it was not alive. As a whole, about 10 per cent of all ages failed to respond directly. Negative responses were obtained concerning the candle since 35 per cent of 6-year-old children said it was alive; this was reduced to 11 per cent at 11 years. The tree and flower were held by a great majority of all ages as living. As regards responses of the question "Are all things that move living?", King pointed out there was evidence that changes in thought and confusion in the minds of the children arose from the child's experience and language, and he explained that when the test material was examined, it was demonstrated that a great number of the subjects who answered 'no' to the last question had earlier said that rivers were alive and, on discussion, they gave the reason that they moved. Other children held that rivers were part of nature and were, therefore, alive, whereas a train was manufactured and was not living.

King attributes this confusion to the fact that "we speak of ships as 'she' and birds as 'it'. Matches are said to be live or dead and *live* coals fall from the fire in winter. We speak of *live* wires in an electric circuit, a meeting or discussion is alive, a town may have

life or be dead ".(1)

The importance of metaphorical expressions as a means of obtaining animistic responses led Simmons and Goss (1957) to conduct a study in order to assess the effects on animistic responses of two experimental conditions: (a) the sentence contexts in which words of the animistic test had appeared and (b) the type of instructions employed in the test for animism.(2)

The test words (e.g. sea, pearl, lightning, match and so on) were introduced in different contexts - scientific statements, animistic suggestions in the form of poetic metaphors, and a mixture of the two types of sentences. They concluded that animistic responses could be ascribed to response-mediated generalization. The use of attributes such as move, change, grow, etc. as reasons for animistic responses showed that the same or similar responses were also aroused by test words and as a result, to the degree that verbalization of these reasons in turn evoked responses such as "living" and "alive", generalization of these responses to the test words would be expected. Consequently, the scientific instructions and sentence contexts were not responded to animistically because they did not affect the occurrence of appropriate mediating responses. It may be presumed that poetic

1- Ibid., p. 14.

2- A. Simmons and A. Goss, "Animistic responses as a function of sentence contexts and instructions", *Journal of Genetic Psychology*, 1957, 91, p. 181.

instructions decreased the use of general scientific criteria and produced significantly increasing number of animistic responses in terms of metaphorical language.(1)

On investigating the causal relationship between animistic thought and the animistic response suggested by Piaget, Paul M. Smeets (1973, 1974) refuted this Piagetian point of view. From the examination of the data obtained, Smeets (1973) concluded that the animistic, deanimistic, or correct response are neither dependent on, nor affected by the process of the animistic thought in the child's mind since the animistic thought may result in animistic, deanimistic, or correct types of answers. Smeets' investigation, based on a portion of his Doctoral dissertation, was conducted on a sample of 60 subjects divided into three groups of retardates, young normals, and older normals. The children were questioned about the attribution of life and six specific life traits (die, grow, feel, hear, know, talk) to some animate and inanimate objects. Then the children were asked to give explanations for their responses. The following are examples used by Smeets to illustrate his argument of the three types of answers obtained in his study:

1. Animistic thought results in an animistic response:

(a) Q: "Is a cloud alive?"

A: "Yes. Because it moves around; it moves
by itself."

1- Ibid., p. 188.

(b) Q: "Does a river feel things?"

A: "Yes, it feels the boat, because it pushes
the river."

2. *Animistic thought results in a deanimistic response:*

(a) Q: "Is a tree alive?"

A: "No, because it has no eyes and cannot
move. When the wind blows it, it moves. It
looks like it is alive then."

(b) Q: "Is a flower alive?"

A: "No, it has no eyes, no nose, no mouth, no
legs, and no hands."

3. *Animistic thought results in a correct response:*

(a) Q: "Does a cloud talk?"

A: "No, it just makes rain. It just cries and
that is rain."

(b) Q: "Does a tree know how tall it is?"

A: "Of course not, boys know how tall they
are, trees don't."

Q: "What makes you think so?"

A: "They are too stiff to look down, like I
can. See, like this"(subject bends over).(1)

In another study, also based on a portion of the same
Doctoral dissertation, Smeets (1974) carried out an
investigation to assess the influence of Mental Age and
Chronological Age on the attribution of life and life

1- Paul Smeets, 'The Animism Controversy Revisited:
A Probability Analysis', *The Journal of Genetic
Psychology*, 1973, Vol. 123, p. 224.

traits to animate and inanimate objects. The number of the subjects and their division into three groups followed the same method used in the study of 1973 mentioned above (e.g. 60 subjects consisted of three groups each containing 10 males and 10 females), but the formulation of the question was slightly different; seven questions were asked about four of the objects: (a) Animals: cat, fish; (b) Plants: tree, flower; (c) Objects moving "on own accord": river, cloud; (d) Objects not moving "on own accord": clock, automobile; (e) non-moving objects: bottle, table.(1) Questions 1 to 6 were applied to all objects while question 7 was formulated specifically for each individual object. Questions were asked of all objects whether they were alive, could grow, die, hear things, feel things, talk, while question 7 was whether 'the object' knew a specific characteristic of its own (e.g. does the flower know its colour, does the table know it is round). Smeets observed that the attribution of life and life traits was neither determined by Mental Age nor by Chronological Age. It was the interaction of Mental Age and Chronological Age that determined the attribution of life to animate objects and the attribution of botanical and animal traits to inanimate object. The attribution of life to inanimate objects and the attribution of botanical, animal, and human traits to

- 1- Paul meets, 'The Influence of MA and CA on the Attribution of life and life traits to Animate and Inanimate objects', *The Journal of Genetic Psychology*, 1974, Vol. 124, pp. 18-19.

animate objects is not dependent on Chronological Age, Mental Age or the combination of the two.(1)

In a more recent study, Merry Bullock (1985) challenged Piaget's generalization of the idea that animism is a central feature of the child's thinking. Bullock's results did not substantiate Piaget's findings or that of other investigators using the Piagetian interview or questionnaire techniques such as Laurendeau and Pinard (1962), and Russell and Dennis (1939).

The technique utilized in Bullock's study was different from that used by previous investigators concerning the objects questioned; the objects were seen by the subjects in videofilms on a television set. The subjects of the experiment, containing 48 children and 16 college-age adults, were brought to a quiet room and shown the films. After seeing the film, a photograph of the object was introduced to the subject who was asked eight questions on features of animate and inanimate objects:

- (1) "Does X have a brain?";
- (2) "If there was a fire could X run away?";
- (3) "Can X grow bigger?";
- (4) "If we forget to give X food, will it get hungry?";
- (5) "If X breaks, can we fix it with glue?";
- (6) "If we put X on a shelf will it stay ^rhere?";
- (7) "Could we buy X in another color?"; and

1- Ibid., p. 23.

(8) "Would it be OK to throw X like a ball?".(1)

Bullock concluded that the attribution of life to inanimate objects did not proceed from a general, 'animistic' attitude of the children's thinking towards all objects. On the contrary, she suggested that the failure of children to discriminate the animate and inanimate qualities of objects came from a general uncertainty about the precise qualities of many objects, regardless of object type.(2)

A series of studies and experiments aiming at investigating the animistic thought in children has been undertaken by Looft, and Looft et al (e.g. Looft, 1973, 1974; Looft and Charles, 1969; Looft and Bartz, 1969; Bickford and Looft, 1973). An attempt was made by Looft (1973) to assess the possible effects of two various testing tasks on the animistic performance of 26 boys and 32 girls aged between 6-8 years. The subjects were selected from two Catholic schools in Madison, Wisconsin. The 58 subjects were assigned to one of two conditions: a verbal condition in which the subjects were asked about eight living objects (frog, honeybee, fish, turtle, flower, turkey, tree, child) and eight nonliving objects (boat, pen, automobile, aeroplane, gloves, watch, coffee cup, camera). The technique used in this verbal condition

- 1- Merry Bullock, 'Animism in Childhood Thinking: A New Look at an Old Question', *Developmental Psychology*, 1985, Vol. 21, No. 2, p. 219.
- 2- Ibid., pp. 223-224.

followed the same Piagetian interview. The second condition was non-verbal in which the second group of the subjects (27 children), were asked to classify pictures of the same 16 objects into living and non-living objects. Looft's results demonstrated that the subjects obtained very high scores in their performance of both conditions, and that there was no difference in the life-concept scores between the two conditions. Looft attributed the children's high performance to the familiarity of the objects to the children's experience, and therefore they responded to them in naturalistic terms. These results were in accord with the findings of other inquiries.(1)

Looft (1974) replicated the previous study with a slight difference in both the objects questioned about and the verbal section of the test. The 16 objects were nearly the same except that child, boat and pen were changed for woman, chair and television. The purpose of this study was to find out the answer to the question 'does the child have knowledge of the attributes or qualities that are implied by the "living" status?'

To achieve this purpose Looft posed four different sets of questions: the standard animism question: 'Is a (object) alive?' with a supplementary question asking the explanation of the answer. The other three sets of questions referred to biological attributes:

- 1- William R. Looft, 'Animistic Thought in Children: Effects of Two Response Modes', *Perceptual and Motor Skills*, 1973, 36, p. 59.

need-for-nutriments, respiration and reproduction. The same technique explained above was carried out. The results revealed that 39 out of 59 children were identified as 'nonanimistic' according to their classification of the 16 objects into 'living and 'nonliving' categories, and that these supposedly "non animistic" children did not completely comprehend the implications of the concept life. A conceptual *horizontal decalage* was suggested, that is to say the generalization of the concept of the need-for-nutriments was grasped better than that of the concept of respiration, and the latter was grasped more accurately than that of the concept of reproduction. These biological qualities proved to be attributed more accurately to nonliving objects than to living objects. Therefore, and as Looft interpreted it, this study is best viewed as a preliminary endeavor¹, one that suggests many future avenues for investigation. The obvious questions pertain to the issues of the *horizontal decalage* of the associated attributes of living, the extent of familiarity or experience with stimulus objects, and the nature of the developmental progression toward the construction of a mature concept of life.(1)

Reviewing the literature on animistic thought, Looft and Bartz (1969) adopted the critical point of view that

1- William R. Looft, "Animistic Thought in Children: Understanding of "Living" Across Its Associated Attributes", *The Journal of Genetic Psychology*, 1974, 124, p.240.

it was the Piagetian lack of a standardized procedure and a consequent lack of quantitative analysis that may have often suggested answers to the children. This view was proclaimed by Munn (1965) who identified the nature of Piaget's questioning as a suggestion of the child's response. For example, instead of asking 'Who put the snow there?', which suggests some personal agency, Piaget should have asked, "How did the snow get there?" In addition to that, Looft and Bartz paid attention to the critical standpoint that 'the stages of animistic thought advanced by Piaget may have been imposed upon the data by Piaget himself'.(1) In the light of their review of the literature on animism, Looft and Bartz argued that animistic-like responses might exist, but the question that has not been answered yet is, "What do they mean?" They took over the writings of Piaget on the subject confirming that the development of the child's conceptions of reality and causality did not occupy a very large place in Piaget's total writing and even Piaget himself regarded these early writings as preliminary investigations to his total work. Moreover, they responded to the question they asked by arguing that the child was thought to adhere to fewer and fewer egocentric notions. Piaget formulated the term "precausality" so as to define these adherences of the child to egocentric notions about the world, which is an "expression which was introduced to represent the

1- William R. Looft and W.H. Bartz, 'Animism revised',
Psychological Bulletin, 1969, 71, p. 2.

explanations intervening between those based on pure psychological and those relating to pure physical causality. Gradually these precausal beliefs are replaced by more objective conceptions of the world".(1)

In an attempt to assess the frequency of animistic thought at various age levels among school children in Ghana, G. Jahoda (1958b) applied a test with two approaches to 120 African children, 60 boys and 60 girls. In one approach of the inquiry he used a story devised by Piaget and subsequently modified by Havighurst and Neugarten. The form devised by the latter, together with their standard series of questions, was taken over by Jahoda after a slight adaptation to make it more suitable for the African milieu. Here it is: "This is a story about two boys. These two boys, named Kofi and Kwame, were out walking and came to a place where a woman was selling oranges. Each of them stole an orange and ran off with it. But the seller saw them and ran after them. She caught Kofi and punished him, but Kwame got away. The same afternoon Kwame was chopping wood, and the cutlass slipped and caught his foot".

Question A: Why do you think Kwame's foot was cut?

Question B: If Kwame did not steal the orange,
would he cut his foot?

1- Ibid., p. 9.

Question C: Did the cutlass know he stole the orange?(1)

In the second part of the investigation he used a more flexible technique in which the interviewer introduced a gramophone to the children asking them to answer the question: "Can you explain to me where the music and songs come from a grammophone [*sic*] ?" As far as the results of the first approach are concerned Jahoda found that a total of 15 subjects responded animistically, but the frequency of animistic thought declined with increasing age in accordance with Piaget's findings. Whereas, the results of the second approach revealed that only 9 subjects gave animistic responses, and these subjects were concentrated in the lowest age groups. Moreover, Jahoda concluded also that cultural factors such as traditional religious beliefs, magical ideas and attitudes towards the products of Western technology were influencing the responses of the children.

In his criticism of the cross-cultural researches concerning child animism, Jahoda (1958a) reviewed some of the main various preceding studies classifying them into ethnic and regional groups under the headlines: (a) White American Children, (b) American Indian Children, (c) Chinese Children, (d) European Children and (e) Manus Children of New Guinea. Jahoda observed what he called the apparent absence of consistent trends on the ground of

1- Gustav Jahoda, 'Child Animism : II. A Study in West Africa', *The Journal of Social Psychology*, 1958, 47, p. 215.



the divergences of animism reported in the studies reviewed ranging from extremely high figures down to zero. He argued that these highly significant differences were probably due to:

(a) The samples in some studies were too small for giving any reliable results (e.g. Dennis and Russell, 1940), and in other cases no information was reported about the subjects other than age (e.g. Huang and Lee, 1945). Therefore, any comparison under such conditions can be very hazardous.

(b) Some investigators conducted tests in a language different from the subjects' mother tongue (e.g. Dennis, 1943) which reflected the unreliability of their test on the ground of the results obtained by Havighurst and Neugarten (1955) when they made an effort to check this by giving their test first in English and about a month later in the vernacular to a selected group of subjects. The results indicate considerable disagreement.

(c) The types of problems presented and the choice of objects varied in many studies which led to various results concerning the existence of animism.

(d) The methods of administration seemed to affect the subjects responses as happened in Russell (1940) and (1942) when he used individual interviews with younger children and a written exercise with older ones. Thus, individual questioning produced a higher proportion of

animism than written procedures.

(e) Personal biases of the investigator may be responsible for the conclusion of Askar (1932) arguing against Piaget's theories, concerning which, Jahoda suggested that due to the negative attitude towards Piaget there was the possibility that Askar's results were influenced. This impression was confirmed by the fact that he tried, somewhat ingenuously, to account for the discrepancies by explaining that the interviews provided more opportunity for "discussion and clarification".(1) As a whole Jahoda concluded that cross-cultural standardization is likely to be no more successful than in the case of intelligence tests.

One of the fairly recent remarkable studies in the field of animism was administered by Siegler and Richards (1983). The authors aimed at identifying objectively points of convergence as well as discrepancy between Piaget's and other investigators' theories within a common framework. In order to attain this goal, the research was based on four various models: a) a model drawn on Piaget's theory; b) a model drawn on Huang and Lee's theory; c) a model drawn on Klingensmith's theory; and d) a model drawn on Laurendeau and Pinard's theory.(2) Then a series of

1- Gustav Jahoda, 'Child Animism: I. A Critical Survey of Cross-cultural Research', *The Journal of Social Psychology*, 1958, 47, p. 210.

2- R. Siegler and D. Richards, "The development of Two Concepts", *Recent Advances in Cognitive-Developmental Theory : Progress in Cognitive Development Research*, ed. Charles Brainerd, New York, 1983, pp. 98-103.

five experiments on the child's concept of life was intended to distinguish among the four models: a) on judgments of life status; b) on prototypic instances of life; c) on effects of emphasizing motion; d) on attributes characteristic of living things; and e) on inferring life from its attributes.(1)

In the first three experiments the investigators were concerned with determining which objects were believed to be alive by the subjects. The last two experiments were intended to examine the attributes that children would impute to living things. The first experiment was confined to only 32 children of 4-5 years old and 6-7 years old. The participants in the third experiment were children of the ages 4-5 (16 children), 6-7 (16 children), and 8-9 (16 children). The other three experiments were presented to a wider age range with slightly larger number of subjects in each age: 4-5 olds, 6-7 olds, 8-9 olds, 10-11 olds, and adults. The actual number of the subjects is not clearly stated, but may be deduced from one of the tables(2), besides the information about the subjects is insufficient.

However, Siegler and Richards's findings in all five experiments ran counter to Piaget's theory. Only one out of the 32 children equated alive with capable of motion in the first experiment. This indicated that the results

1- Ibid., pp. 103-111.

2- See Ibid., Table 2-6, p. 105.

were in line with the other three theories and incompatible with Piaget's supposition that young children would ascribe life to things alive or moving. The results of the second experiment were consistent with those of the first one. Initially, children believe that people and animals are alive. Then living things would include plants, and finally parts of living things would be seen as alive. The movement of things that are not plants or animals tended to be no criterion for ascribing life to these things.(1) The results of the third experiment were similar. In the fourth experiment the results showed two trends in the children's understanding of life's attributes. First, when most children began to recognize plants and animals as alive, they also began to identify many more attributes of life than before. Corollary to this, the children's responses became less idiosyncratic and more applied to animals and plants.(2) The results of the last experiment revealed that children as young as 8 and 9 years old had stronger associations between life and its necessary and sufficient attributes than between life and attributes that were only sufficient for or correlated with it, and there was no evidence that children or adults discriminated between attributes correlated with life and attributes that were sufficient indicators of life. Viewed in this light, the overall results were at odds with Piaget's theory.

1- Ibid., p. 106.

2- Ibid., p. 108.

3.4 CONCLUSION

From the studies reviewed in this chapter, one can deduce some salient points. First, and as usual in any controversial case, these studies may be divided into three main categories:

(1) Studies which are in complete congruency with Piaget's theory of animism and the inability of the young children to formulate their concept of "alive". The findings of these studies substantiate the Piagetian theory as far as both its universality and its four stages are concerned (e.g. Russell, 1939, 1940a, 1940b, 1942; Russell and Dennis, 1939, 1941; Dennis, 1942; Russell, Dennis and Ash, 1940; Bruce, 1941; and Safier, 1964).

(2) Studies which are in complete incongruency with Piaget's theory of animism regarding its universality (e.g. Huang and Lee, 1945; Mead, 1932; Klingberg, 1957; Siegler and Richards, 1983; Bullock, 1985; Berzonsky, 1970, 1971b, and 1974; Nass, 1956; Looft, 1973, 1974).

(3) Studies confirming the existence of animistic thought of various degrees while ascribing it to factors neglected by Piaget and his followers such as familiarity with the objects, the child's range of language, the formulation of the questions, the child's experience, and traditional and cultural factors (e.g. Smith and Dougherty, 1965; Strauss, 1951; Smeets, 1973, 1974; King, 1961; Klingensmith, 1953; Jahoda, 1958b; Dewart, 1979a,

1979b).

Secondly and in strict parallelism with the first conclusion in Jahoda (1958a), most of these studies, whether with or against Piaget, were conducted on small samples; (e.g. Mead, 1932 (41 S); Dennis and Russell, 1940 (24 S); Russell and Dennis, 1941 (92 S); Dennis, 1942 (only his daughter), 1943 (98 S); Huang and Lee, 1945 (40 S); Bruce, 1941 (137 S); Safier, 1964 (30 S); Nass, 1956 (120 S); Jahoda, 1958b (120 S); Klinberg, 1957 (97 S); Berzonsky, 1971 (84 S); Klingensmith, 1953 (142 S); Smeets, 1973, 1974 (60 S); Looft, 1973 (58 S), 1974 (59 S); Bullock, 1985 (64 S); and many others). The fact that these studies were conducted on small samples may rightly give rise to much doubt about the reliability of the results obtained from these studies since their small samples may not be considered real representations for the whole communities of the children from which the samples were drawn.

Thirdly, these studies used varieties of technique, methods and procedures, different from each other on the one hand and from Piaget's on the other. Therefore it is natural that the results obtained could vary as much as the various technical approaches permit.

Finally and most important, none of these studies can be considered completely cross-cultural in the sense that none of the investigators, for one reason or another,

conducted the same test with stability of variables on two groups of children selected from two different cultures. Some studies took advantage of the findings of other studies to make the cross-cultural or ethnic comparison (e.g. Jahoda, 1958b; Huang and Lee, 1945; Dennis and Russell, 1940; Dennis, 1943; Havighurst and Neugarten, 1955; Mead, 1932).

CHAPTER FOUR

ANIMISM : PRACTICAL STUDY

We made from water every living thing.

(Kor'an : XXI.30)

There is not a thing but celebrates His praise ; and
yet ye understand not how they declare His glory!

(Kor'an : XVII.44)

It is He Who brings out the living from the
dead, and brings out the dead from the living,
and Who gives life to the earth after it is dead.

(Kor'an : XXX.19)

* * * * *

4.1 HYPOTHESES

The primary purpose of the study of animism has been to investigate this concept in the child's mind as a preliminary to the cross-cultural study of the child's cognitive development with relation to Piaget's theory and is an attempt to test the following hypotheses:-

1- That animism is a generally universal characteristic of the child's cognitive development.

2- That the child's concepts of life and death move towards accuracy with the same four stages given by Piaget.

3- That the four Piagetian developmental stages of the child's animistic thinking are universal in the sense that they manifest themselves in both degree and sequence among the children of both England and Egypt. In general terms, the children of developed countries should think animistically as much as the children of developing countries.

4- That if the third hypothesis is rejected and there is shown to be a significant difference in degree and sequence in the children's animistic thinking, gender does not play an important part in the child's attribution of life and death to inanimate objects.

5- That, as a corollary to the fourth hypothesis, cultural and environmental factors play a more significant

role than gender in the child's attribution of life or death to inanimate objects.

4.2 METHODS AND PROCEDURE

4.2.1 Subjects

A grand total of 389 children were selected from both England and Egypt in order to participate in this preliminary investigation through being interviewed individually by the researcher. The subjects' ages ranged from 5 to 11 years old. A total of 185 English boys and girls were randomly taken from Durham. They were classified in number according to age and sex as shown in table 4.1.

Table (4.1)
Descriptive Data Regarding the English

Age in yrs	Male	Female	Total
5	12	17	29
6	13	12	25
7	16	7	23
8	13	13	26
9	9	19	28
10	11	12	23
11	16	15	31
Total	90	95	185

English children aged from 5-7 years were randomly obtained from Newton Hall County Infants school, County of Durham and the children aged from 8 to 11 were obtained from Blue Coat School in the same area. Table 4.2 shows the average ages in months for each year group.

Table (4.2)
Means and Standard Deviations of English Children

Age Groups	Sex	N.		SD
5	Male	10	61.70	3.92
	Female	17	63.06	3.47
	Total	27	62.56	3.63
6	Male	14	74.14	3.61
	Female	12	75.17	3.83
	Total	26	75.15	3.64
7	Male	17	87.35	3.84
	Female	7	89.00	3.51
	Total	24	87.83	3.75
8	Male	12	102.42	2.54
	Female	12	102.67	1.87
	Total	24	102.54	2.19
9	Male	10	113.70	2.54
	Female	20	114.40	2.44
	Total	30	114.17	2.45
10	Male	11	127.55	2.42
	Female	13	127.23	1.96
	Total	24	127.38	2.14
11	Male	16	139.31	1.70
	Female	14	138.79	1.53
	Total	30	139.07	1.62

In the Egyptian sample, a total of 204 boys and girls were taken from the city of Aswan.(1) Their distributions in number, age and sex are shown in table 4.3.

Table (4.3)
Descriptive Data Regarding the Egyptians

Age in yrs	Male	Female	Total
5	12	18	30
6	10	19	29
7	13	14	27
8	13	15	28
9	17	13	30
10	15	15	30
11	17	13	30
Total	97	107	204

All Egyptian subjects were randomly obtained in such a way that the investigator was given name lists alphabetically ordered. Then some names from each list were chosen and the headmaster asked to bring the children indicated. Boys and girls aged 6-11 years were taken from Ali Nasser Primary School in Aswan, while children of 5 years old were obtained from the Nursery attached to the same school. Except for those children of age 5 whose parents could financially send them to private nurseries, the

1- More detailed information about Durham and Aswan is included in the introduction and chapter six.

majority of Egyptian children tested belonged to what could be called the middle socioeconomic class in Egypt. Table 4.4 shows the distributions of the average ages in months for each age level of the Egyptian sample.

Table (4.4)
Means and Standard Deviations of Egyptian Children

Age Groups	Sex	N.		SD
5	Male	12	63.33	2.99
	Female	18	63.72	2.99
	Total	30	63.57	2.94
6	Male	9	74.67	3.64
	Female	18	75.50	3.45
	Total	27	75.22	3.47
7	Male	14	86.21	3.40
	Female	15	86.93	4.11
	Total	29	86.59	3.74
8	Male	13	102.77	2.52
	Female	14	102.57	1.83
	Total	27	102.67	2.15
9	Male	18	115.33	2.97
	Female	14	114.64	2.90
	Total	32	115.03	2.91
10	Male	14	127.64	3.65
	Female	12	125.00	2.73
	Total	26	126.42	3.47
11	Male	18	138.9	2.04
	Female	15	138.87	2.29
	Total	33	138.91	2.13

4.2.2 Procedure

The researcher chose 19 various objects as subjects for the test. These objects were intentionally and carefully selected to avoid any confusion that might arise in the child's mind from being unfamiliar with them. In other words, the child's familiarity with the objects selected was maintained as far as possible. The objects were shown to the subjects in their serial position of presentation as follows:

- | | |
|----------------------------|--------------------------|
| 1- A flower in pot (alive) | 10- China lady |
| 2- Snake (dead) | 11- Toad (alive) |
| 3- Frog (dead) | 12- Plant in pot (alive) |
| 4- China bird | 13- Candle |
| 5- Fish (dead) | 14- Wooden crocodile |
| 6- Insect (alive) | 15- Clock work head |
| 7- Stone | 16- Lizard (dead) |
| 8- Water | 17- Shrew (dead) |
| 9- Dogfish (dead) | 18- Fish (alive) |
| | 19- Teddy bear |

Each object was separately introduced to the child who was asked two questions about it. The first question was multi-choiced, according to which the child had to choose the answer applicable to the object in front of him/her. The threefold question was:

- a) Is it alive?
- b) Is it dead? or
- c) Has it ever been alive?

The second question, which followed immediately after the child's response to the first question was 'Why do you think it is (alive ... etc.?). These simple questions were originally set in English. Hence, the researcher believed that no problem could arise from the wording of the question. The standpoints taken by others such as Nass (1956), and especially Klingberg (1957), about the posing of the question, "Has it life?" instead of, "Is it living?"(1) was covered as the problem presented to the child contained the question, "Is it dead?" to contrast with, "Is it alive?" the meaning of the term 'alive' was undoubtedly clear to each child.

The problem faced by the researcher lay in the translation of the first question into Arabic. Perhaps, one may say, it is very easy to translate such simple words into any language. On the contrary, it is far from easy, especially if one, dealing with children, tries to give equally the precise meaning of the English question and to avoid any sort of confusion that might occur to the Egyptian children. The problem as seen by the researcher was two-sided: a) the pronoun 'it', and b) the colloquial Egyptian Arabic. In classical Arabic there is no pronoun that equals 'it' in regard to its neutral personal function. Instead Arabs use either the personal pronouns ('he'; *howa*) for masculine and ('she'; *heya*) for

1- G. Klingberg, 'The distinction between living and not living among 7-10- year-old children with some remarks concerning the so-called animism controversy', 1957, pp. 234-235.

feminine, or ('this'; *hatha*) for masculine and ('this'; *hathehi*) for feminine. Thus, in literary translation it is easy to use one of the previous pronouns, but in the oral Egyptian they are rarely used. So, the second side of the problem was a corollary of the first. Indeed, there was no way that the pronoun 'this' could be used to replace 'it', which is rendered in the colloquial Egyptian Arabic *da* or *di*, each according to its sex in Arabic context. Thus, the variables of the child's familiarity with the object, and of his understanding of the question's wording were made sure of as far as possible as from the investigator's point of view.

The subject's response to the first question was classified into four categories in terms of right and wrong since this question would be quantitatively assessed. In order to facilitate this process, the researcher changed the options of the child's answers into numbers on her own sheet of the answer recording: alive was No.1, dead No.2, has never been alive No.3, and "I do not know" or refraining from answering No.9.

An effort was made by the investigator to establish rapport with each age group prior to the interview. Then each child was interviewed individually by means of conversation-interview in a private room where the objects concerned were displayed on the experimenter's table in the same order of presentation described above. As predicted, each child took from 15 to 20 minutes to

complete the test. With some older children the time was reduced to 10 minutes each. Before asking the child, a further effort was made to re-establish individual rapport with him/her through instructing him/her that: "We are friends, aren't we? I am sure you like to help your friends, and as I told you all before it is not an examination". Pointing to the objects "These are the things I am going to ask you about and you will help me if you answer the questions carefully, Will you?" The majority of children were nodding as a sign of satisfactory agreement at this point. However, in all cases no suggestion was made by the experimenter to help the subject to choose his/her answer under any circumstances.

As far as the second question was concerned, it would be analysed qualitatively in terms of the children's explanations of the reasons for their choices. For this purpose, the researcher employed a cassette recorder in order not to miss any word of the children's explanations and to make them available for later classification.

The test was carried out on the English sample in the period from the first to the fifteenth of July 1983. Unfortunately, it was delayed for the Egyptian sample till the third to the twentieth of April 1984 for reasons beyond the researcher's control (e.g. official and governmental technicalities and procedure for obtaining permission to visit Egypt and administer the tests).

4.2.3 Statistical Analysis

The data obtained were analysed through the SPSS-X (Statistical Package for Social Sciences) programme available at Durham University Computer Centre, which utilized Michigan Terminal System (MTS). The Chi-Square analyses were applied to compare groups and to test for the significance of differences found between various age, sex, and cultural groups. Generally, Yates' correction was used when degrees of freedom equalled 1. In cases of 2x2 contingency tables, the Chi-Square test required that the expected frequencies in each cell should not be less than 5. When the contingency tables contained more than 2x2 cells, the rule applied was not to let more than 20 per cent of the cells have expected frequencies less than 5 or none of the cells have an expected frequency less than 1. If these requirements were not met in some cases, adjacent categories were combined in order to increase the expected frequencies (Siegel, 1956)(1), and (Roscoe and Byars, 1971).(2)

The Kruskal-Wallis one-way analysis of variance by ranks was also employed as a statistical technique in processing the data. The 0.05 level was accepted as indicating statistical significance.

- 1- Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences*, International Student Edition, McGraw-Hill, Inc., 1956.
- 2- John T. Roscoe and J. A. Byars, "An Investigation of the Restraints with Respect to Sample Size Commonly Imposed on the Use of the Chi-Square Statistic", *Journal of the American Statistical Association*, Dec.1971, vol.66. No.336., pp.755-9.

4.3 RESULTS

All answers were first statistically analysed as to whether they were right, wrong, or unanswered (do not know). The results obtained did not support Piaget's findings (1929), Russell (1939; 1940a; 1940b), Russell and Dennis (1939; 1941), Russell and collaborators (1940), Laurendeau and Pinard (1962), nor Bruce (1941) in respect to the generalization of animism as a prominent characteristic of the child's thinking, despite the fact that it was noted that a small proportion of the subjects, who either attributed life to inanimate objects or failed to distinguish a living object from a dead one, gave evidence to the Piagetian four stages of development in various degrees in both English and Egyptian samples. More specifically, the existence of this animistic thinking was mainly concentrated in the lower ages and tended to disappear with increasing age. On the other hand the results substantiated the findings of studies such as Huang and Lee (1945), Berzonsky (1971), Nass (1956), Smith and Dougherty (1965), King (1961), Smeet (1974), Looft (1973) in general, and Jahoda (1958b) and Bullock (1985) in particular that children's misattributions of animacy did not arise from a general animistic attitude towards all inanimate objects.

On the whole, children of all age levels did not face any difficulty in realising that the insect, toad, and fish were alive (e.g. ranging from 94.2 per cent

concerning insect, 97.1 per cent concerning fish to 99.6 per cent concerning toad in Egyptian subjects; and from 98.4 per cent concerning fish to 98.9 per cent concerning toad and insect in English subjects), while their performance with the flower and plant was relatively less successful as shown in Table (4.5).

Table (4.5)

Percentages of Egyptian (G) and English (E) subjects at each age who correctly judged that the living objects introduced to them were alive

Object	Sub. Loc.	Age Levels						
		5	6	7	8	9	10	11
Insect	G	83.3	100	82.8	92.6	100	100	100
	E	92.6	100	100	100	100	100	100
Toad	G	96.7	100	100	100	100	100	100
	E	92.6	100	100	100	100	100	100
Fish	G	80.0	100	100	100	100	100	100
	E	88.9	100	100	100	100	100	100
Flower	G	33.3	37.0	69.0	74.1	96.9	100	100
	E	44.4	26.9	75.0	83.3	100	100	100
Plant	G	60.0	77.8	69.0	77.8	96.9	100	100
	E	66.7	73.1	83.3	83.3	90.0	91.7	100

The observation revealed that the concept of life in the children's mind was steadily advancing towards maximum accuracy with progressing age. The most successful example of the children's advanced performance was clearly found in the case of the "toad" in all age groups, while the lowest was reflected in the case of the 'flower', especially at age 5, although the children reached a

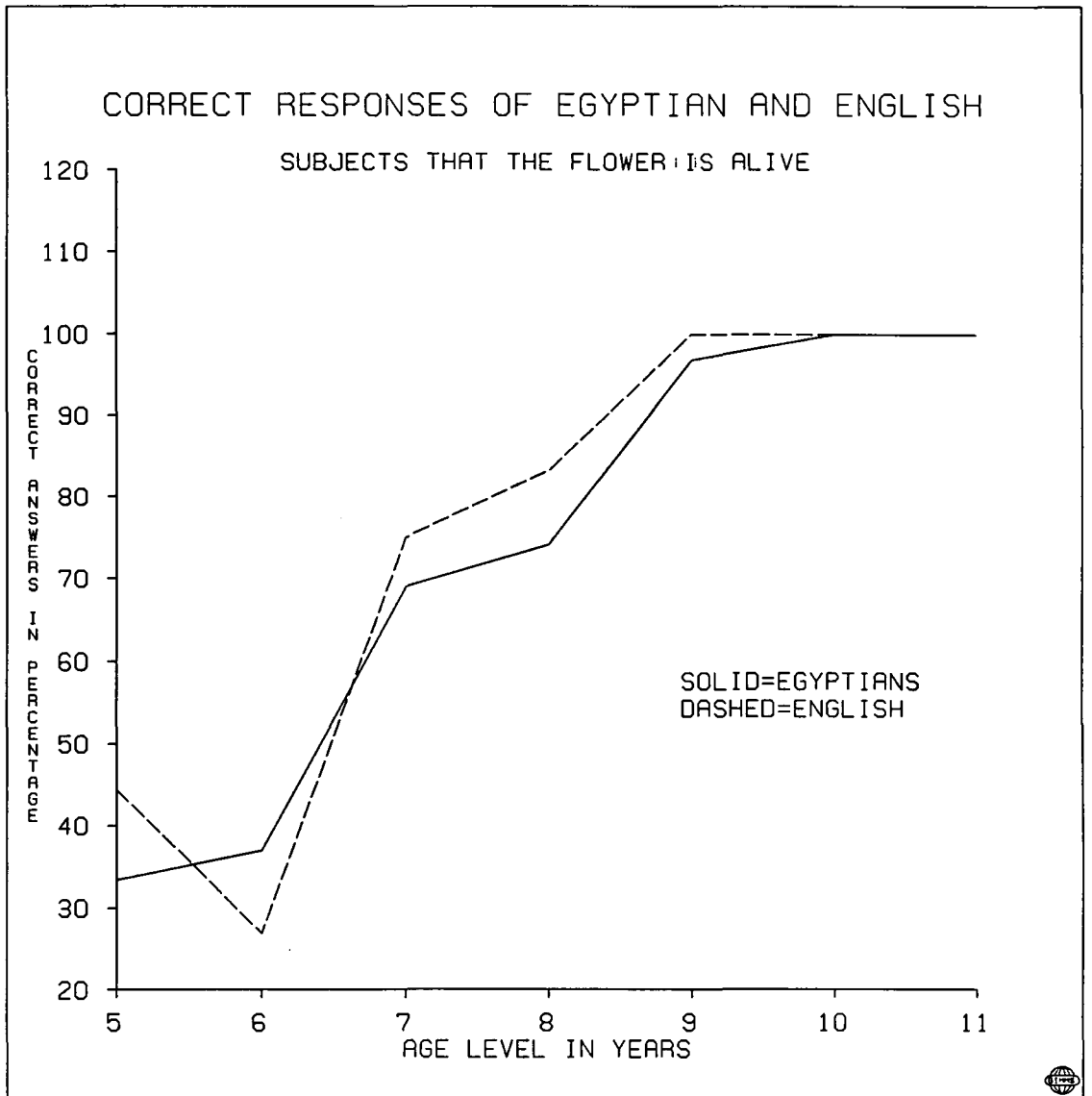
hundred per cent accuracy at ages 10 and 11 as shown in Figure 4.1.

As regards the concept of death, the majority of children in both countries did not fail to state correctly that the snake, frog, fish, dogfish, lizard, and shrew were dead with nearly the same high degree of success displayed in their responses to the living animate objects. Table 4.6 shows the high proportions of the children's performance as a whole.

Table (4.6)
Percentages of Egyptian and English subjects at each
age who correctly judged that the dead objects
introduced to them were dead

Objects	Sub. Loc.	Age Levels						
		5	6	7	8	9	10	11
Snake	G	76.7	74.1	79.3	88.9	96.7	95.8	97.0
	E	70.4	88.5	91.7	96.9	100	95.8	96.7
Frog	G	60.0	59.3	79.3	88.9	87.5	96.2	100
	E	55.6	73.1	79.2	91.7	83.3	91.7	100
Fish	G	70.0	70.4	79.3	85.2	96.9	96.2	100
	E	48.1	76.9	75.0	91.7	90.0	91.7	100
Dogfish	G	60.0	74.1	82.8	81.5	90.6	100	100
	E	59.3	88.5	83.3	83.3	86.7	87.5	93.3
Lizard	G	53.3	74.1	79.3	88.9	87.5	100	100
	E	59.3	76.9	79.2	95.8	90.0	95.8	100
Shrew	G	53.3	70.4	79.3	88.9	93.8	92.3	97.0
	E	40.7	69.2	62.5	91.7	93.3	100	96.7

FIG. 4.1



The concept of death reached a hundred per cent accuracy in most cases at the ages of 10 and 11 years although it started as low as 40.7 per cent at the age of 5 years. An example of the growing accuracy of the concept of death in the minds of the children of both cultures is demonstrated in Figure 4.2.

Nevertheless, the inanimate objects were said to be alive in a small proportion of cases. As for the older ages the attribution of life to bird, stone, lady, candle, teddy, and crocodile almost disappeared from the children's responses, while its respective concentration was observed in the younger ages, especially in the case of the candle. In this respect the results revealed that the most successful answers to inanimate objects were obtained in most cases from 9-year-old subjects (Figure 4.3). That water and clock were alive gained the highest incorrect responses of the children (Table 4.7) the reasons for which will be discussed later.

Table (4.7)

Percentages of all children who attributed life to the eight inanimate objects in increasing order

Objects	Attribution of life in %
Crocodile	1.8
Stone	3.3
Bird	3.6
Lady	3.9
Teddy	4.6
Candle	9.8
Clock	26.4
Water	35.5

FIG. 4.2

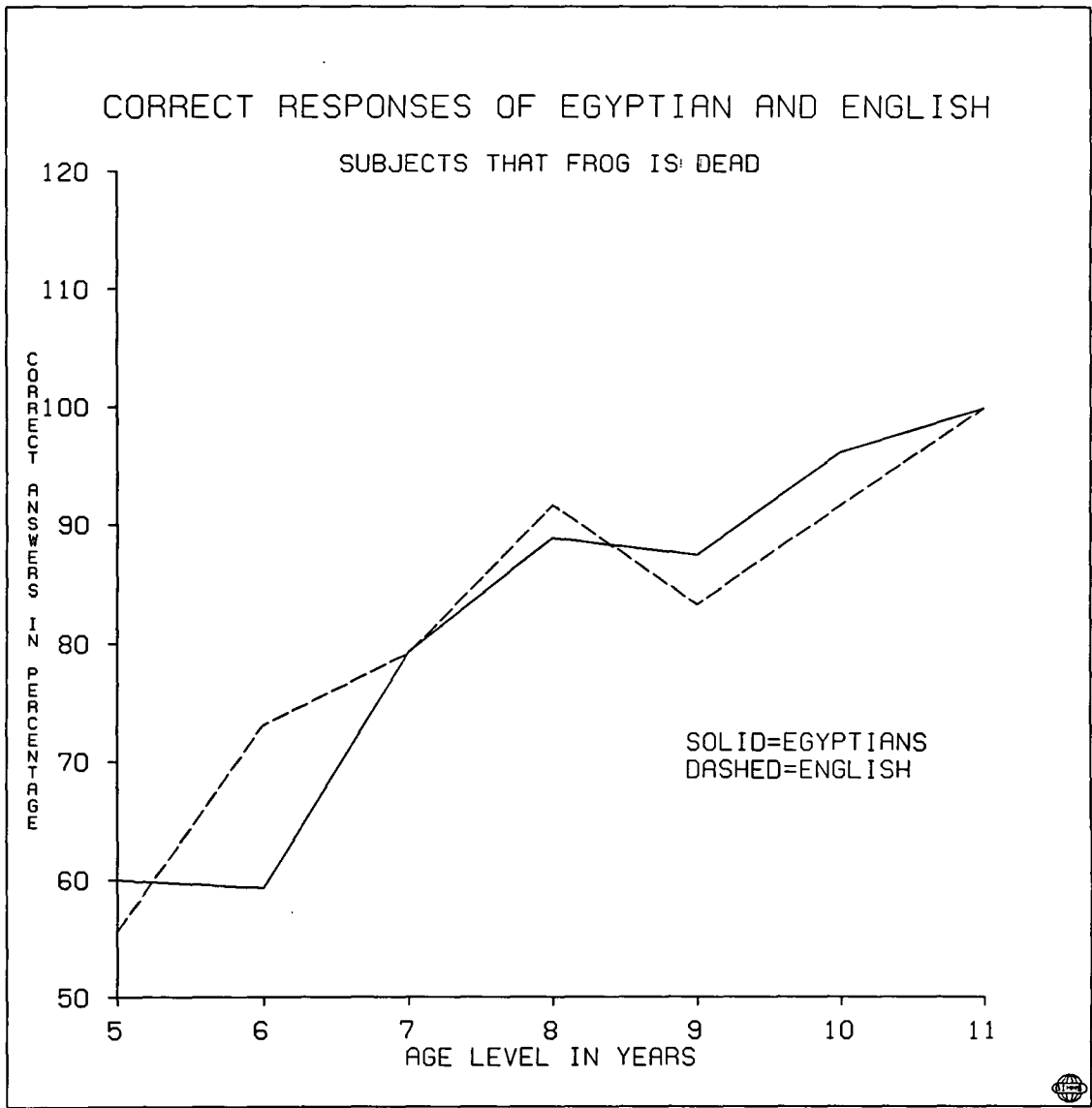
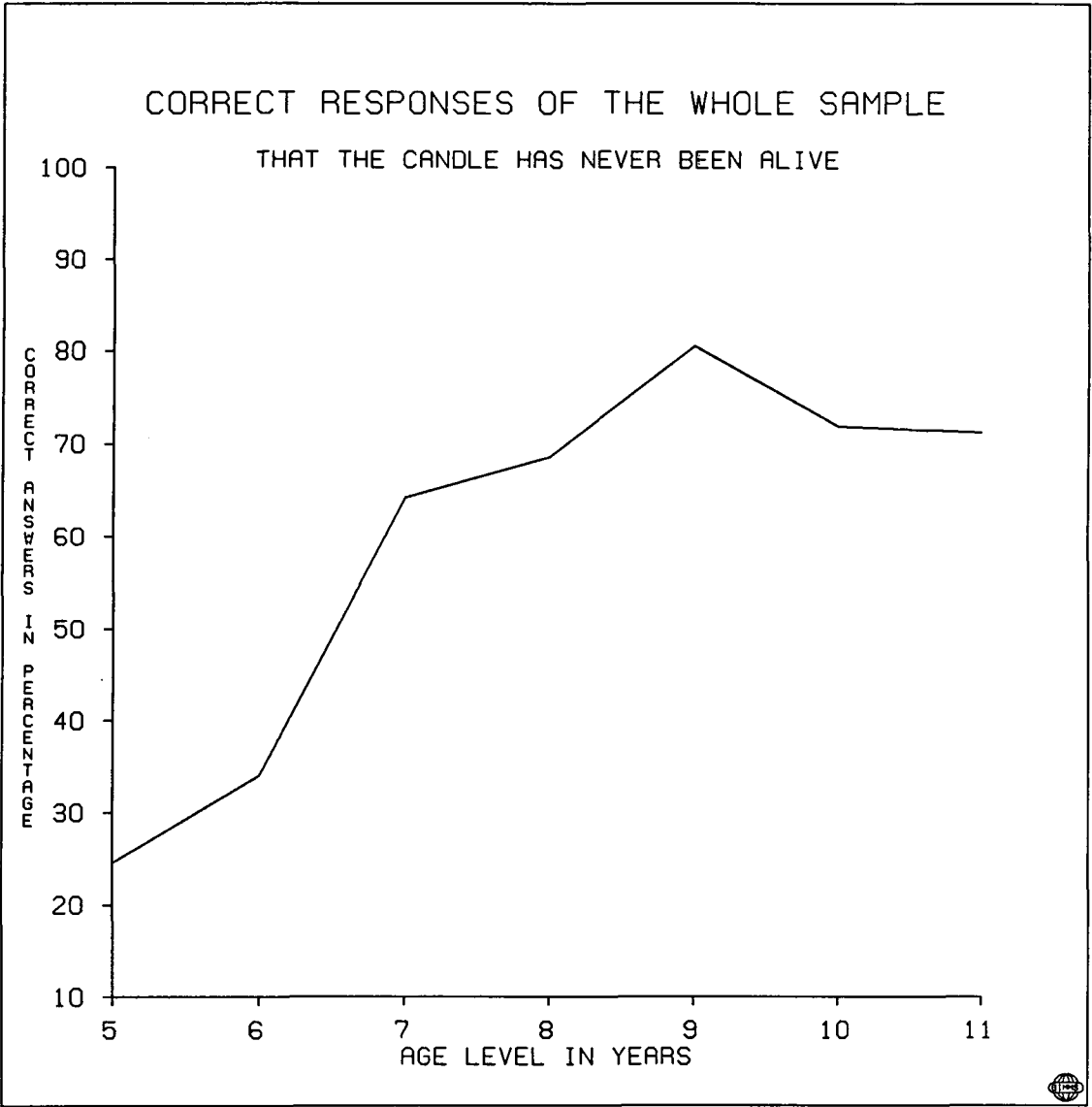


FIG. 4.3



It was also observed that the attribution of life to inanimate things on the basis of its movement was not a decisive variable by which the quality of "alive" was identified by the majority of children despite the fact that it might be the reason behind the apparently higher proportion ascribing life to the clock in comparison with other inanimate objects with the exception of water. However, there was no definite age at which the decrease or increase of the proportion attributing life to the clock could be determined. It started with 45.6 per cent in the 5-year-old children decreasing to 22.6 per cent in the 7-year-old children, then increasing again to 33.3 per cent in the 8-year-old children, while decreasing to 16.1 per cent in the 9-year-old children taking a higher proportion of 24.0 per cent in the 10-year-old children and finally reaching its lowest level in 11-year-old children (11.1 per cent).

4.3.1 Sex Differences in the Egyptian Sample

The correct answers of the Egyptian children that the flower, insect, toad, plant and fish were alive showed variations which were not statistically significant between sexes at the younger ages and an almost complete convergence at the older ages. At 5 years boys and girls equally achieved the same percentage of 33.3 per cent as regards the flower, and 83.3 per cent as regards the insect, while boys performed a little better in the case

of toad as they achieved 100 per cent, the girls scoring 94.4 per cent. In the cases of plant and fish the situation was reversed, the girls achieved 66.7 per cent for the plant and 83.3 for the fish, while the boys scored 50 per cent for the former and 75 per cent for the latter. At 6 years the responses of boys and girls concerning the living objects were absolutely convergent at 100 per cent in the cases of insect, toad, and fish, while the boys' answers were a little lower (33.3 per cent) in the case of flower and a little higher (88.9 per cent) in the case of plant as girls' score being 38.9 per cent in the former and 72.2 per cent in the latter. At 7 years onward the performance of boys and girls was exactly the same (100 per cent) in cases of toad and fish, and they maintained the same score at 9, 10 and 11 years in the case of insect, and at 10 and 11 years in the cases of flower and plant. An insignificant divergence occurred at 7 years as 86.7 per cent of girls and 78.6 per cent of boys thought that the insect was alive, whereas in the cases of flower and plant the boys steadily kept their 71.4 per cent in both instances, the girls also kept maintained a lower score of 66.7 per cent in both cases. In the cases of flower and plant the 8-year-old boys scored 76.9 per cent which rose to 94.4 per cent at 9-year-old, while the 8-year-old girls achieved a lower response of 71.4 per cent for flower and a higher response of 78.6 per cent for the plant which increased to 100 per cent in both cases at 9 years. At 8 years all boys said that the insect was

alive while 85.7 per cent of girls gave the correct answer.

To test the statistical significance of the difference between Egyptian sexes concerning the responses to animate objects, chi-square was determined for ratings of correct, incorrect, and no answer at each age group. See Tables 1-7 in apendices.

As regards the answers that the snake, frog, fish, dogfish, lizard and shrew were dead, the results pointed to the fact that the concept of death in the minds of the Egyptian children was as well assimilated as the concept of life. However, it was noticed that the lowest score (50 per cent) in the category of dead objects achieved by 5-year-old girls was higher than the lowest score girls and boys had in the category of living objects which was 33.3 per cent, and that the frequency of the maximum accuracy in the dead object was less than that in the live object. A part from these two generally slight differences between the correct responses of the Egyptian children to the category of living objects and their responses to the category of dead objects, the results demonstrated that there were no statistically significant differences between boys and girls. Both boys and girls of the Egyptian sample were steadily matching each other in their progress with increasing age towards perfect and accurate understanding of the concept of death. Table 4.8 shows that in the case of lizard 6-year-old girls achieved

a higher score of 83.3 per cent than boys of that age who achieved only 55.6 per cent, and 9-year-old boys were more successful in scoring 94.4 per cent than girls who scored only 78.6 per cent. Moreover, there were two clear differences in results between 9-year-old and 10-year-old children in the case of the shrew. The 9-year-old boys were less successful than the girls, but the position was reversed at 10 years old where there was a difference of 14.3 per cent in favour of the boys

Table (4.8)

Percentages of Egyptian boys and girls at each age who correctly judged that dead objects introduced to them were dead

Age	Sex	Dead Objects					
		Snake	frog	fish	dogfish	lizard	shrew
5	M	66.7	66.7	66.7	58.3	58.3	50.0
	F	83.3	55.6	72.2	61.1	50.0	55.6
6	M	77.8	66.7	66.7	77.8	55.6	66.7
	F	72.2	55.6	72.2	72.2	83.3	72.2
7	M	78.6	78.6	78.6	85.7	78.6	78.6
	F	80.0	80.0	80.0	80.0	80.0	80.0
8	M	92.3	84.6	84.6	84.6	84.6	92.3
	F	85.7	92.9	85.7	78.6	92.9	85.7
9	M	100	88.9	100	94.4	94.4	100
	F	92.9	85.7	92.9	85.7	78.6	85.7
10	M	100	92.9	100	100	100	85.7
	F	100	100	91.7	100	100	100
11	M	100	100	100	100	100	94.4
	F	93.3	100	100	100	100	100

The results obtained indicated that Egyptian children's attribution of life to bird, stone, crocodile and teddy occurred only at the age of 5 years in a very small percentage and a hardly noticed difference between boys and girls, while all children of all age level did not see any of the four inanimate objects as alive. At 5 years 11.1 per cent of girls and none of the boys said that the bird was alive, 16.7 per cent of the boys and 22.2 per cent of the girls stated that stone was alive, 8.3 per cent of the boys and 5.6 per cent of the girls answered that the wooden crocodile was alive, and 16.7 per cent of boys and 11.1 per cent of girls judged that the teddy bear was alive. The attribution of life to the lady extended to the age of 6 years, and to the age of 7 years in the case of the candle, although the differences between boys and girls were statistically insignificant. As regards the lady, 8.3 per cent of the boys and none of the girls of 5 years old saw it as alive, whereas none of the boys and 5.6 per cent of the girls of 6 years old gave the same answer. For the candle the differences in percentage between boys and girls of the three lower age levels were clearly manifested, especially at 5 and 7 years, where 25.0 per cent of boys and 5.6 per cent of girls of age 5 said it was alive. Twenty two per cent of boys and 33.3 per cent of girls at age 6, and 14.3 per cent of boys and 40.0 per cent of girls of age 7 gave the same wrong answer. Again, despite this apparently high percentage difference between boys and girls of lower ages in respect

to their attribution of life to the candle, the chi-square analysis indicated that for 5-year-old children (chi square = 6.80, df = 3) at the 0.10 level of confidence, the difference was not significant. To be significant at the 0.05 level, a chi square of 7.82 would be required.

Though the performance of the Egyptian children as a whole in the case of the clock was very much less successful than it was in the other cases of inanimate objects (with the exception of water), the difference between sexes was statistically insignificant. Table 4.9 illustrates the high percentage of both boys and girls attributing life to the clock, and Figure 4.4 shows that the greatest difference between boys and girls appeared at the age of 10 years in favour of the boys.

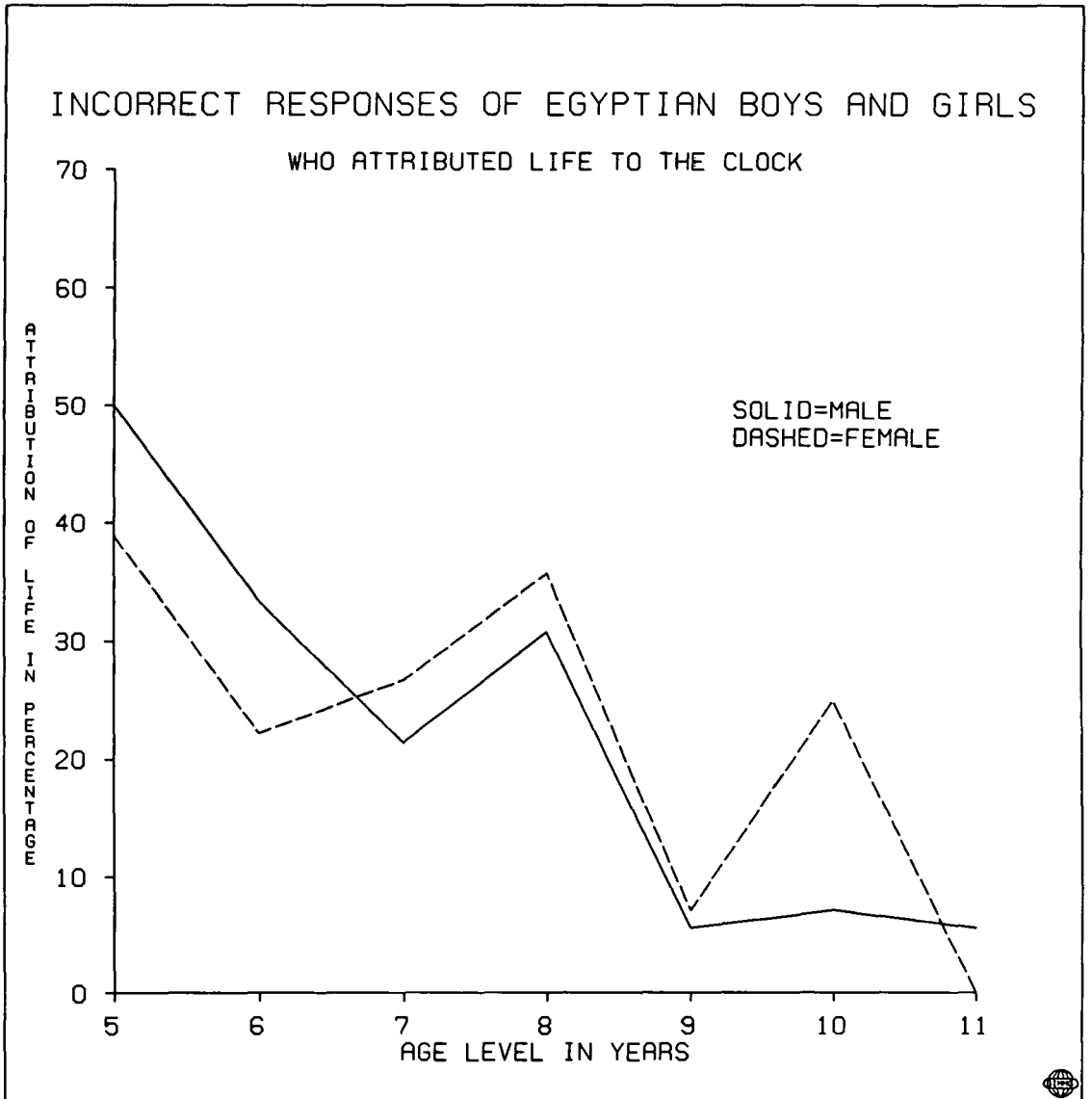
Table (4.9)

Percentages of Egyptian boys and girls who judged
that the clock was alive

Sex	Age Levels in Years						
	5	6	7	8	9	10	11
Male	50.0	33.3	21.4	30.8	5.6	7.1	5.6
Female	38.9	22.2	26.7	35.7	7.1	25.0	-

The table shows also that despite this high percentage of the children's attribution of life to the clock, it tended to decrease with increasing age, albeit with a degree of fluctuation among age levels. Only in the case of the water did the Egyptian children of all ages (boys

FIG. 4.4

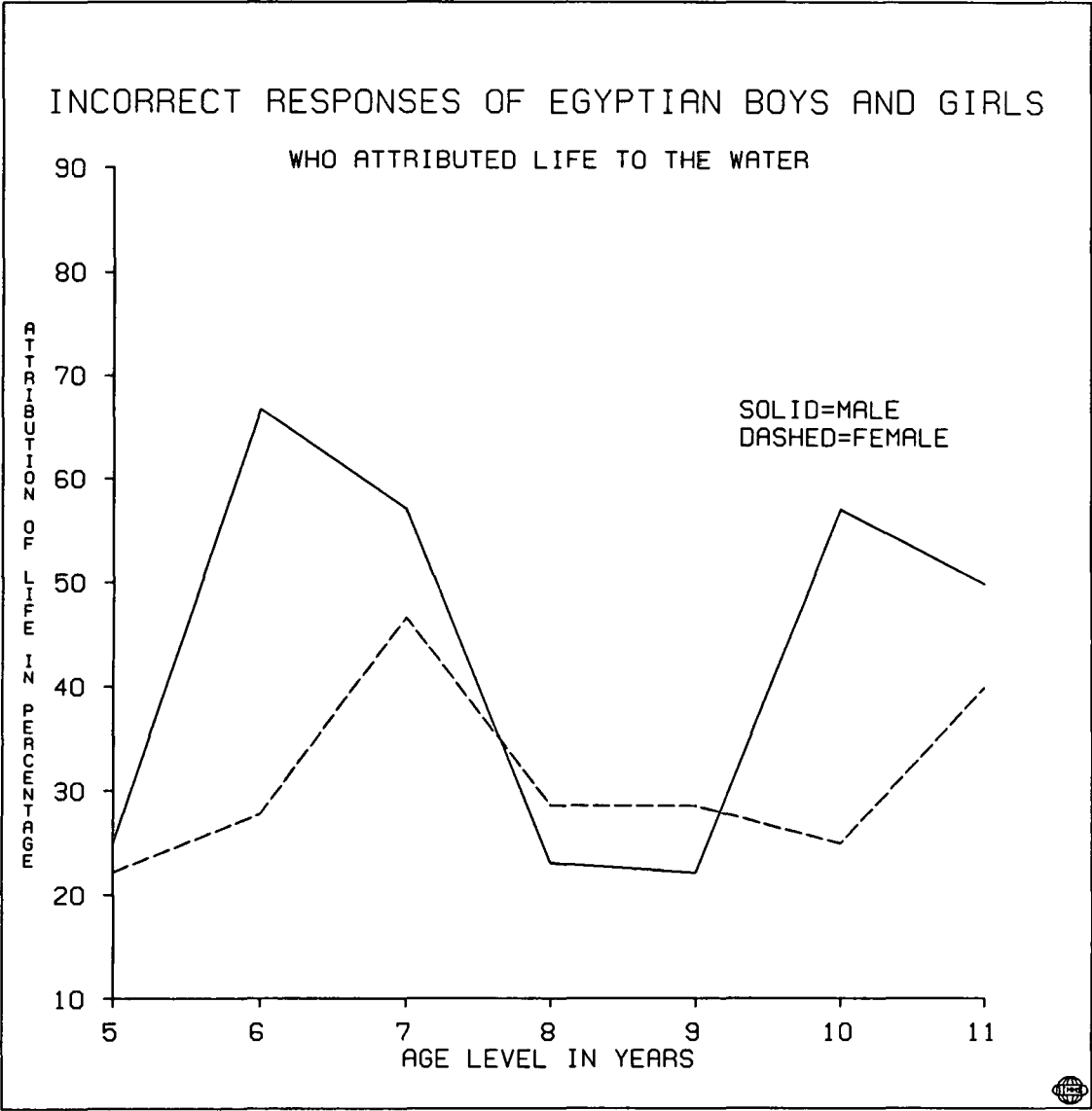


and girls alike) face a great difficulty in giving the correct answers. Additionally, the children's attribution of life to the water was reversed with increasing age, in the sense that it started with a small percentage of 22.2 of 5-year-old girls and ended with 50.0 per cent of 11-year-old boys accompanied by vacillation of high and low percentages among age levels in between (Figure 4.5).

4.3.2 Sex Differences in the English Sample

For the five living objects, similar patterns of responses to that of the Egyptian sample were obtained from the English children. Identical answers in both samples occurred in the cases of the toad and fish, where all children from age 6 stated that the two objects were alive, while at 5 years, 90 per cent of boys and 94.1 per cent of girls said that the toad was alive, and 90 per cent of boys and 88.2 per cent of girls gave the same answer regarding the fish. That the insect was alive scored the same percentage of correct answers which the English children gave for the toad, which means that the sex differences in correct responses to the three objects (insect, toad, fish) were hardly noticeable at 5 years and had completely disappeared at 6 to 11 years. In the case of the flower, all children from ages 9 to 11 judged it correctly. At 5 and 6 years, girls performed far more successfully than boys. Five-year-old boys scored 30 per cent against 52.9 per cent for the girls, and only 14.3 per cent of 6-year-old boys and 41.7 per cent of the same age girls managed to see that the flower was alive,

FIG. 4.5



which was the biggest difference in percentage in favour of girls. There was a very slight variation in favour of boys at 7 years (76.5 per cent of boys) and (71.4 per cent of girls) and they managed to enhance the difference at 8 years where boys scored 91.7 per cent and girls achieved only 75.0 per cent. That the plant was alive did not cause any difficulty for the girls at almost any age and they were more successful than boys (Table 4.10).

Table (4.10)

Percentages of English boys and girls at each age who correctly stated that the plant was alive

Sex	Age Levels in Years						
	5	6	7	8	9	10	11
Male	60.0	64.3	76.5	75.0	80.0	81.8	100
Female	70.6	83.3	100	91.7	95.0	100	100

In testing the statistical significance of the difference between English sexes in respect of the responses to the case of the flower, the chi-square analysis revealed that at 6 years, the children (chi-square = 2.51, df = 2) were at the 0.30 level of confidence, which was not significant, to be significant at the 0.05 level, a chi square of 5.99 would be required.

...Despite the fact that the frequency of maximum scores achieved by English boys, girls or both together in the category of dead objects was less than that which occurred

in the category of living objects, the differences between boys and girls regarding their understanding of the concept of death were slightly less noticeable than they were in the previous category. Through all age levels boys managed to score a hundred per cent accuracy 16 times against 13 times for girls. At 11 years of age, boys and girls achieved maximum scores in the cases of the frog, fish, and lizard, while only boys did that in the case of the snake, and only the girls in the case of the dogfish, and shrew, but in no case was the difference more than 12.5 per cent (Table 4.11).

Table (4.11)

Percentages of English boys and girls at each age who correctly judged that dead objects introduced to them were dead

Age	Sex	Dead Objects					
		Snake	frog	fish	dogfish	lizard	shrew
5	M	70.0	60.0	30.0	50.0	50.0	30.0
	F	70.6	52.9	58.8	64.7	64.7	47.1
6	M	78.6	57.1	64.3	78.6	64.3	50.0
	F	100	91.7	91.7	100	91.7	91.7
7	M	88.2	70.6	64.7	76.5	70.6	58.8
	F	100	100	100	100	100	71.4
8	M	91.7	91.7	100	83.3	100	91.7
	F	75.5	91.7	83.3	83.3	91.7	91.7
9	M	100	100	100	90.0	100	100
	F	95.0	75.0	85.0	85.0	85.0	90.0
10	M	100	90.9	100	100	100	100
	F	92.3	92.3	84.6	76.9	92.3	100
11	M	100	100	100	87.5	100	93.8
	F	92.9	100	100	100	100	100

The biggest difference occurred in the case of the shrew at 6 years where 50.0 per cent of boys and 91.7 per cent of girls stated that the shrew was dead. Despite this high difference in percentage, chi-square test revealed no significant differences between the sexes (chi square = 5.77, $df = 2$) at the 0.10 level of confidence, to be significant at the 0.05 level, a chi square of 5.99 would be required.

The results revealed that all the English boys and girls of age 11 years did not ascribe life or death to the china bird, stone, china lady, wooden crocodile, or teddy bear. In other words, these five inanimate objects were judged by 11-year-old boys and girls alike as never having been alive. The same result was obtained by 9-year-old boys and girls concerning bird, stone, lady, candle, and crocodile. At 10 years boys and girls repeated this identical result of maximum accuracy in seeing that the stone, crocodile and teddy as never having been alive. With the exception of water and clock, the only object which did not reach the maximum accuracy at 11 years was the candle where 6.3 per cent of boys but none of the girls saw it as alive. At 5 years old 10.0 per cent of boys and 5.9 per cent of girls attributed life to the bird. None of the boys, but 5.9 per cent of girls gave the same answer about the stone and the crocodile. Twenty per cent of boys and 11.8 per cent of girls judged that the lady was alive, 30.0 per cent of boys and 17.6 of

girls ascribed life to the candle, and 10.0 per cent of boys and 17.6 per cent of girls gave the same answer about the teddy. At 6 years 14.3 per cent of boys ascribed life to the bird, stone, lady, and candle against 25.0, 8.3, 25.0, and 8.3 per cent of girls respectively. None of the boys and 8.3 per cent of girls attributed life to crocodile, and 7.1 per cent of boys and 25.0 per cent of girls provided the same answer for teddy.

None of the 7-year-old girls stated that the bird, stone, lady, candle, crocodile, and teddy were alive, while 11.8, 11.8, 5.9, 5.9, 5.9, and 5.9 per cent of boys in the same order of objects saw them as alive. Boys and girls of age 8 equally attributed life to the bird, crocodile and teddy with percentages of 8.3, 8.3, and 16.7, while 8.3 per cent of boys and none of girls saw the stone as alive, 8.3 per cent of girls stated that the lady and the candle were alive against none and 16.7 per cent of boys who provided the same answer respectively.

As has been indicated before, with the exception of the water and the clock, there was no difference in accurate responses to inanimate objects between boys and girls at age 9 except in the case of the teddy where 5.0 per cent of girls and none of boys saw it as alive. 10-year-old girls performed slightly better than boys in the cases of the bird, lady and candle; 9.1 per cent of boys and none of girls stated that the bird was alive, 18.2 per cent of boys and none of girls gave the same answer about the

lady, and so did 27.3 per cent of boys and 7.7 per cent of girls for the candle. As far as the clock and water were concerned, the children's attribution of life to both objects was considerably higher to the extent that neither boys nor girls at any age level reached the maximum accuracy although the difference between sexes with regard to the clock was statistically insignificant, (Table 4.12 and Figure 4.6) even where the highest variation happened at age 9 years (10.0 per cent of boys and 35.0 per cent of girls attributed life to the clock). The chi square was 2.34 at the 0.50 level of confidence, $df = 2$. To be significant at the 0.05 level, a chi square of 5.99 would be required.

Table (4.12)

Percentages of English boys and girls who judged
that the clock was alive

Sex	Age Levels						
	5	6	7	8	9	10	11
M	60.0	57.1	23.5	25.0	10.0	27.3	25.0
F	41.2	41.7	14.3	41.7	35.0	38.5	14.3

There was a very high percentage of the children who attributed life to water with a high difference of 41.9 per cent in favour of girls at 10 years and of 36.7 per cent at age 11. Figure 4.7 shows the fluctuation of the incorrect answers of boys and girls through age levels to the extent that it was very hard to define any age at which the attribution of life to the water might disappear

FIG. 4.6

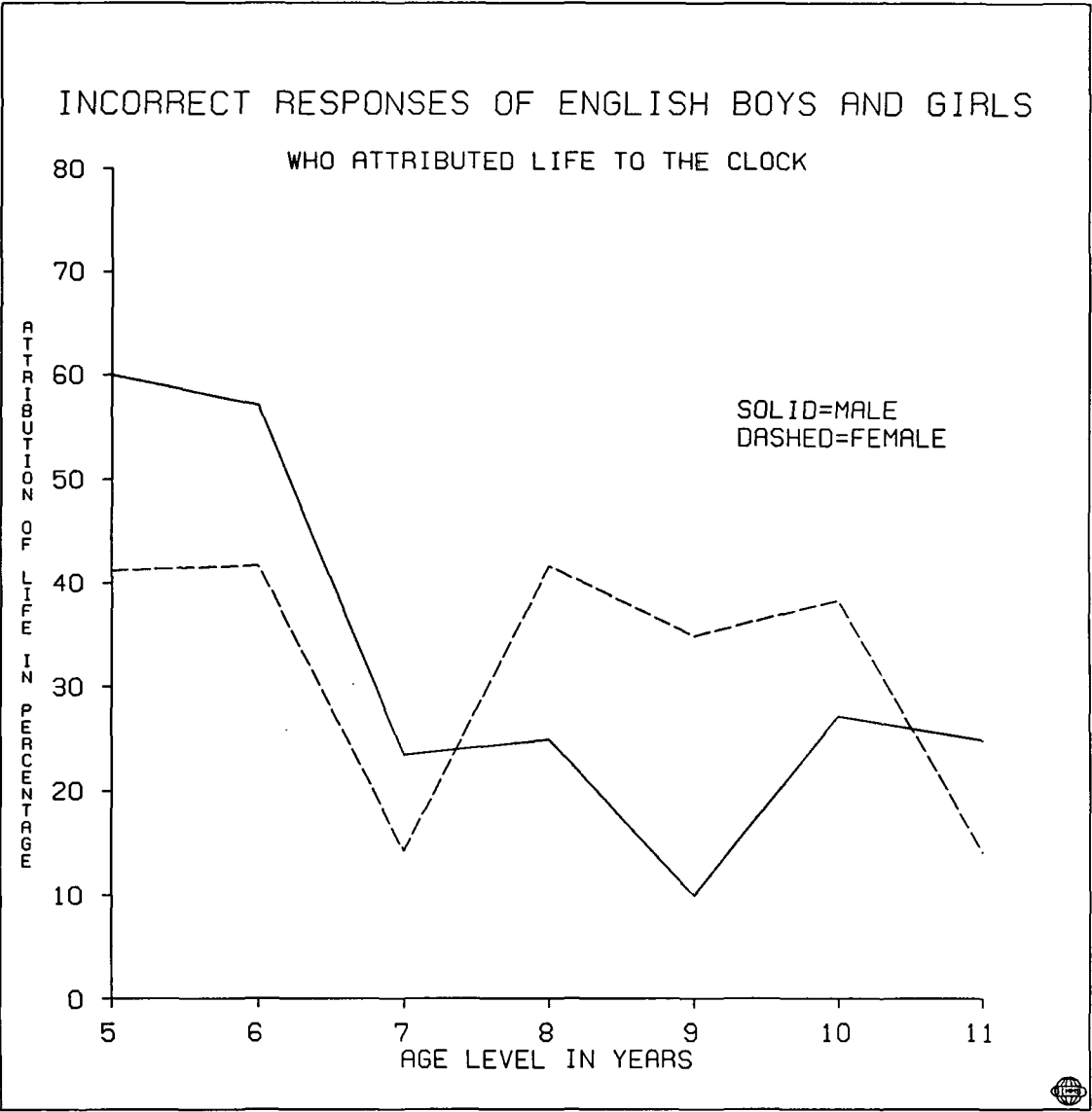
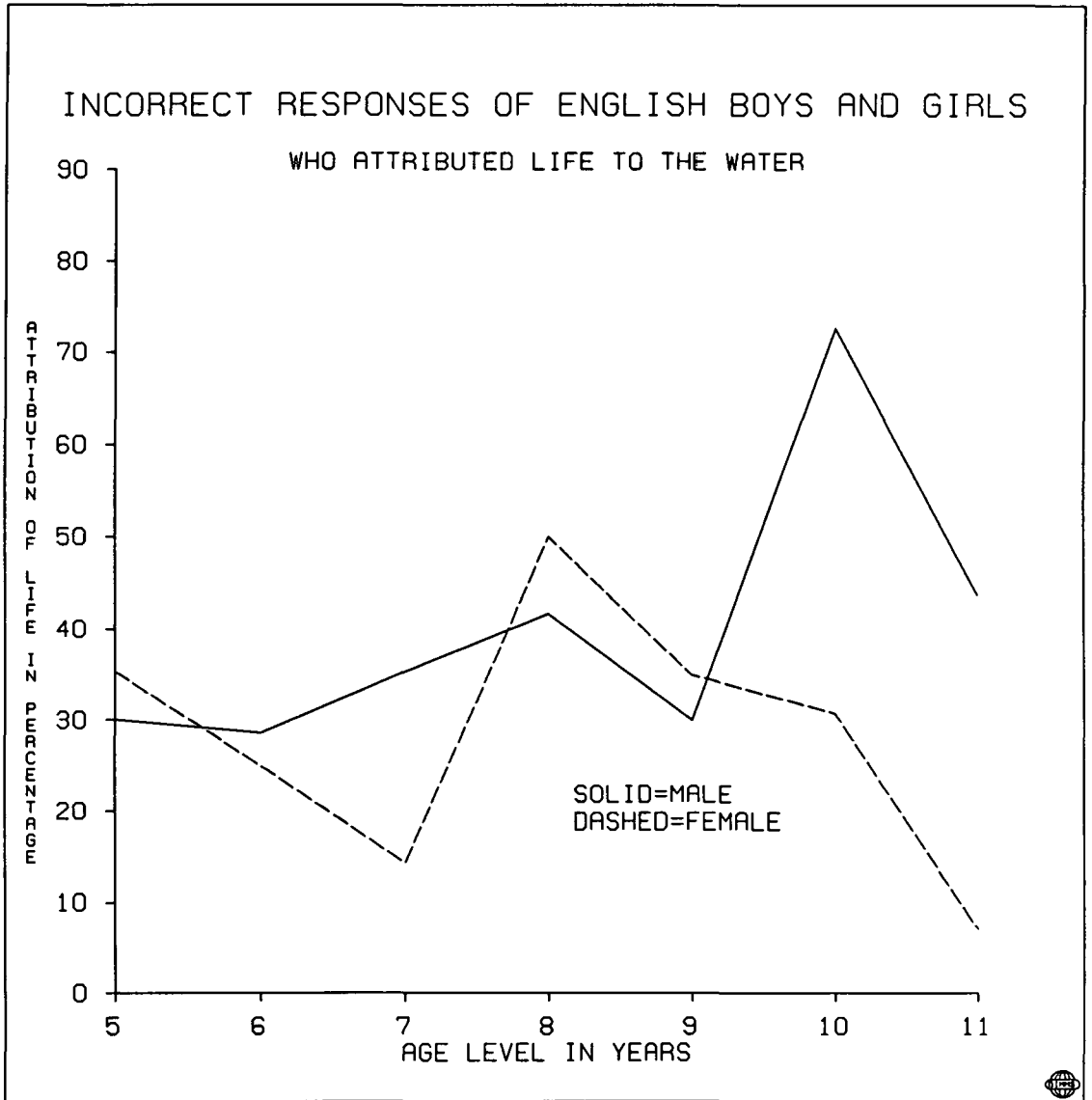


FIG. 4.7



or even decrease. At 10-year-old (chi square = 5.47, df = 2) at the 0.20 level of confidence; at the 11-year-old (chi square = 5.47, df = 2) at the 0.10 level of confidence. To be significant in both ages at the 0.05 level, a chi square of 5.99 would be required.

4.3.3 Results of Cultural Variations

When compared, the results indicated that the correct responses of Egyptian and English children to the objects testing the conception of life did not show any significant variations at any age. Nearly the same can be said with regard to the correct answers testing the conception of death except at age 5 in the case of the dead fish which demonstrated that the Egyptian children were more confident that the dead fish was dead while English children were more likely to categorize it as "has never been alive" or as inanimate (Table 4.13).

Table (4.13)

Percentages of correct and incorrect responses of Egyptian (G) and English (E) Children of age 5 to the dead fish

Sub. Loc.	Responses				χ^2	D.F.
	alive	dead	never	no answer		
G	-	70.0	16.7	13.3		
E	7.4	48.1	44.4	-	1.984	1
T	3.5	59.6	29.8	7.0		

There were, however, statistically significant differences with regard to the correct answers to all inanimate objects observed in all age levels with a heavy concentration in 11-year-old children, with the exception of 5 and 8 year old children. The focus of the comparative results here will be on the significant variations between the two samples (for comprehensive comparison see Tables 15-21 in the appendices). Only in the case of water did the English children of ages 7, 10, and 11 demonstrate any positive significant difference from the Egyptian children. This was indicated by the chi square analysis for 7-year-old children (chi square = 7.88, $df = 3$) at the 0.05 level of confidence; for 10-year-old children (chi square = 20.45, $df = 3$) at the 0.0001 level of confidence, which is highly significant; for 11-year-old children (chi square = 10.96, $df = 3$) at the 0.01 level of confidence.

On the other hand, the significant variations in the responses to the rest of the inanimate items (bird, candle, stone, clock, crocodile, lady and teddy bear) tended to be in favour of Egyptian children. Table (4.14) shows that the significant differences were consistent at the age of 11 years concerning all inanimate objects, and at the age of 10 years they were significant in half the cases. Children of ages 6 and 7 years demonstrated these significant differences in two cases each. When the data were tabulated to make comparison between the sexes of the

Table (4.14)
Significant differences in responses of Egyptian and English
children as regards inanimate objects in percentage

Object	Age	Categories												X ²	D.F.
		alive			dead			never			no answer				
		G	E	T	G	E	T	G	E	T	G	E	T		
Bird	6	-	19.2	9.4	18.5	38.5	28.3	63.0	42.3	52.8	18.5	-	9.4	12.938**	3
	11	-	-	-	9.1	40.0	23.8	90.9	60.0	76.2	-	-	-	6.660**	1
Water	7	51.7	29.2	41.5	-	20.8	9.4	41.4	45.8	43.4	6.9	4.2	5.7	7.884*	3
	10	42.3	50.0	46.0	-	12.5	6.0	7.7	37.5	22.0	50.0	-	26.0	20.451***	3
	11	45.5	26.7	36.5	21.2	43.3	31.7	15.2	30.0	22.2	18.2	-	9.5	10.955**	3
Candle	7	27.6	4.2	17.0	-	41.7	18.9	72.4	54.2	64.2	-	-	-	17.006***	2
	10	-	16.7	8.0	7.7	33.3	20.0	92.3	50.0	72.0	-	-	-	11.538***	2
	11	-	3.3	1.6	6.1	50.0	27.0	93.9	46.7	71.4	-	-	-	14.969***	1
Stone	11	-	-	-	15.2	50.0	31.7	84.8	50.0	68.3	-	-	-	7.272**	1
Clock	9	6.3	26.7	16.1	3.1	20.0	11.3	84.4	53.3	69.4	6.3	-	3.2	11.933**	3
	11	3.0	20.0	11.1	6.1	30.0	17.5	90.9	50.0	71.4	-	-	-	12.912***	2
Crocodile	11	-	-	-	9.1	56.7	31.7	90.9	43.3	68.3	-	-	-	14.293***	1
Lady	11	-	-	-	9.1	46.7	27.0	90.9	53.3	73.0	-	-	-	9.435***	1
Teddy	6	-	15.4	7.5	29.6	50.0	39.6	63.0	34.6	49.1	7.4	-	3.8	9.637*	3
	11	-	-	-	9.1	43.3	25.4	90.9	56.7	74.6	-	-	-	8.002**	1

* p ≤ 0.05 > 0.01
 ** p ≤ 0.01 > 0.001
 *** p ≤ 0.001

Table (4.15)

Significant differences in responses of Egyptian
and English females to inanimate objects in percentage

Object	Age	Categories												χ^2	D.F.
		alive			dead			never			no answer				
		G	E	T	G	E	T	G	E	T	G	E	T		
Bird	5	11.1	5.9	8.6	11.1	52.9	31.4	61.1	41.2	51.4	16.7	-	8.6	8.655*	3
	6	-	25.0	10.0	22.2	41.7	30.0	61.1	33.3	50.0	16.7	-	10.0	8.519*	3
Candle	7	40.0	-	27.3	-	57.1	18.2	60.0	42.9	54.5	-	-	-	11.629***	2
Clock	9	7.1	35.0	23.5	-	20.0	11.8	85.7	45.0	61.8	7.1	-	2.9	4.185*	1
	11	-	14.3	6.9	13.3	42.9	27.6	86.7	42.9	65.5	-	-	-	6.552*	2
Water	10	25.0	30.8	28.0	-	15.4	8.0	8.3	53.8	32.0	66.7	-	32.0	14.626**	3
	11	40.0	7.1	24.1	13.3	50.0	31.0	20.0	42.9	31.0	26.7	-	13.8	11.328*	3

* $p \leq 0.05 > 0.01$
 ** $p \leq 0.01 > 0.001$
 *** $p \leq 0.001$

two samples the differences between Egyptian and English girls tended to be reduced to almost half the differences above indicated. Table (4.15) shows that there were significant variations between Egyptian and English girls of 11 years in only 2 cases (clock and water), at the ages of 5, 6, 7, 9, and 10 in one case each. Approximately the same can be said about the boys of the two cultures with regard to the reduction of the cases showing significant differences. Table (4.16) indicates that boys of age 11 demonstrated these differences in one case (wooden crocodile), at 7 and 10 years in one case each (candle), while the differences disappeared at other age levels.

Table 4.16

Significant differences in responses of Egyptian and English boys to inanimate objects in percentage

Object	Age	Loc.	Categories			χ^2 X	D.F
			alive	dead	never		
Candle	7	G	14.3	-	85.7	6.284*	2
		E	5.9	35.3	58.8		
		T	9.7	19.4	71.0		
	10	G	-	7.1	92.9	9.339**	2
		E	27.3	36.4	36.4		
		T	12.0	20.0	68.0		
Croco- dile	11	G	-	11.1	88.9	5.958**	1
		E	-	56.3	43.8		
		T	-	32.4	67.6		

* $p < 0.05 > 0.01$

** $p < 0.01 > 0.001$

It was also noticeable that the water emerged as the most

significant case showing differences between the two cultures, yet there were no significant differences between boys of the two cultures concerning their performance on it.

The results also revealed that there were no significant differences between Egyptian boys compared to English boys, or Egyptian girls compared to English girls with regard to the concepts of life and death.

In the light of the data obtained from the two cultural samples, a further analysis was made so as to make a combined age-level comparison, or rather a stage-group comparison. Stage 1 consisted of children of the two ages 5 and 6; stage 2 consisted of children aged 7 and 8 years; and stage 3 was a combination of older children aged from 9 to 11 years. When the data were tabulated for this stage comparison between English and Egyptian children, there were statistically significant differences that did not appear through the comparison between age levels. The difference was significant in the case of the shrew at stage 1 (5-6 years), where (chi square = 8.58, df = 3) at the 0.04 level of confidence. This difference was insignificant at 5 and 6 years when they were taken separately. The differences were also consistently significant at stage 3 (9-11 years) with regard to six inanimate objects (lady, water, candle, clock, stone, teddy); at stage 2 (7-8 years) with regard to three inanimate objects (water, candle, and teddy); and at stage

Table (4.17)
Significant differences in responses of Egyptian and English
children as regards inanimate objects in percentage

Object	Age groups	Categories												X ²	D.F.
		alive			dead			never			no answer				
		G	E	T	G	E	T	G	E	T	G	E	T		
Stone	9-11	-	-	-	6.6	36.9	21.1	93.4	63.1	78.9	-	-	-	22.287***	1
Bird	5-6	3.5	13.2	8.2	17.5	39.6	28.2	63.2	45.3	54.5	15.8	1.9	9.1	15.356**	3
Lady	5-6	3.5	17.0	10.0	31.6	39.6	35.5	59.6	39.6	50.0	5.3	3.8	4.5	7.823*	3
	9-11	-	2.4	1.1	8.8	31.0	19.4	91.2	66.7	79.4	-	-	-	16.520***	2
Water	7-8	39.3	37.5	38.5	3.6	20.8	11.5	50.0	37.5	44.2	7.1	4.2	5.8	8.006*	3
	9-11	-	6.0	2.9	7.7	35.7	21.1	91.2	57.1	74.9	22.0	2.4	12.6	19.681***	3
Candle	7-8	14.3	8.3	11.5	7.1	33.3	19.2	73.2	58.3	66.3	5.4	-	2.9	13.447**	3
	9-11	-	6.0	2.9	7.7	35.7	21.1	91.2	57.1	74.9	1.1	1.2	1.1	28.414***	3
Croco- dile	9-11	-	-	-	7.7	42.9	24.6	92.3	57.1	75.4	-	-	-	27.277***	1
Teddy	5-6	7.0	15.1	10.9	22.8	49.1	35.5	57.9	32.1	45.5	12.3	3.8	8.2	13.437**	3
	7-8	-	10.4	4.8	28.6	27.1	27.9	64.3	62.5	63.5	7.1	-	3.8	9.295*	3
	9-11	-	1.2	0.6	15.4	39.3	26.9	84.6	59.5	72.6	-	-	-	12.584***	1
Clock	9-11	7.7	26.0	16.6	5.5	21.4	13.1	84.6	52.4	69.1	2.2	-	1.1	25.868***	3

* p ≤ 0.05 > 0.01
 ** p ≤ 0.01 > 0.001
 *** p ≤ 0.001

1 concerning three inanimate objects (bird, lady, and teddy). With the exception of the case of water, these significant differences were in favour of the Egyptian children (Table 4.17).(1)

4.4 DESCRIPTIVE DATA REGARDING SUBJECTS' EXPLANATIONS

As far as the second question of the test 'why do you think so' is concerned, all explanations of the children were arranged according to the classification scheme used by Nass (1956) and developed by Berzonsky (1971) and modified by the investigator. Berzonsky used three categories: 1) "I don't know", 2) Nonnaturalistic, and 3) Naturalistic.(2) Two other categories derived from the third category used by Nass and Berzonsky were added by the investigator in order to be more specific about naturalistic explanations. The classification scheme was as follows:

1. *Positively Naturalistic*. This category included explanations of only the correct responses to the first question and which were scientifically and logically acceptable to educated adults.

2. *Positively pseudo-Naturalistic*. This category was a subdivision of the first category in the sense that it

1- For comprehensive results of the comparison see Tables 23-25 in the appendices.

2- Berzonsky, "The role of familiarity in children's explanations of physical causality", *Child Development*, 1971, 42, p. 710.

included the explanations of only the correct answers to the first question, but the explanations involved were based on intermediate traits between living and nonliving objects such as the insect was alive because it was 'moving', the flower was alive because it 'smelled good', the plant was alive because it is 'dancing', the china bird has never been alive because 'it did not make sounds', or 'it is man-made', 'it is made of clay "pottery", the water has never been alive because 'we drink it, use it in washing, and it does not object'. Thus, explanations of the correct answers in terms of moving, swimming (floating), running, hitting, smelling good (bad), which are not confined only to living objects, were classified under this category.

3. *Negatively Naturalistic*. This category included such explanations of the wrong answers to the first question which tended to be wrong because of the child's inability to describe the traits by which he/she correctly judged the object as alive, dead, or inanimate. In other words, the three concepts seemed to be clear in the child's mind through his/her explanations, but the answer was wrong such as the flower or plant was dead because 'it does not breath, eat', and the dead frog was alive because 'it is sleeping now, when it wakes you will see it playing and jumping'. Conditioned explanations were included in this category such as the teddy was 'alive if it cries when you throw it', and 'if the insect flies when you open the jar,

it is alive, but now it is dead because it does not make any move' (at that time the insect was quite still). This category included also explanations of the wrong answers which were logically inferred despite its being scientifically wrong such as 'the water was alive because what gives life must have life', 'it has oxygen and carbon dioxide so it breathes', and it was dead because 'it is liquid', and it was alive because 'it evaporates'; the wooden crocodile was alive because 'it is made of wood, wood comes from the tree, the tree is alive, so it is alive'.

4. *Negatively Nonnaturalistic*. This category included the explanations of the wrong answers to the first question which were explained in terms of the existence or influence of God, or a supernatural or superstitious power (Jinni, nymph of water). Phenomenistic explanations or instances where irrelevant or coincidental antecedent events were chosen as cases of some other events were also included such as water was alive because "it frightens me", "kills children", 'praises God', etc.

5. *Nil and unclassifiable*. This included 'I don't know', 'Just I think so', 'I am sure of that', 'Daddy or Ma tells me', 'complete silence' and shoulder shrugs. The following is a list of the types of explanations given by the children for their responses to the water. This list does not include the children who gave no answer to part one, so "Nil" refers to the child's inability to

explain his/her correct choice in part one : Egyptians
(G)=175 out of 204, and English (E)=179 out of 185:

The water was alive because: G E

-It has oxygen and carbon dioxide, so it breathes.	9	7
-It helps (waters) plants and/or trees, flowers, cats, man grow (to make them grow).	14	16
-It is a liquid.	3	4
-It gives life and must have life.	4	1
-Without it we die.	2	3
-It moves in the sky before coming down as rain.	1	5
-It moves fast, destroys houses (floods), and hits hard (as in waterfalls, high waves).	5	2
-We cannot hold it in our hands (slippery).	1	2
-It carries ships, boats (us in swimming).	4	5
-It helps us clean our bodies (faces, hands).	3	4
-It makes sounds when it is running (its sound frightens me).	3	2
-It cries on fire when boiling.	-	2
-God says so (it praises God like us).	13	-
-God created it as such.	5	3
-It hides the Jinnee (a spirit) that kills children.	1	-
-Nil and unclassifiable.	6	7

It was dead because:

-We use (drink) it.	4	9
-It does not feel (has no feeling).	2	5
-It has no eyes and cannot see.	1	2

-It comes from the sky (the sky pours it)	1	2
-It is liquid and evaporates.	2	11
-It has no soul.	2	1
-It is not alive.	1	3
-It has no colour or smell.	3	6
-The wind pushes (plays with) it.	-	3
-Nil and unclassifiable.	2	3

It has never been alive because:

-It is composed of gases (oxygen and carbon dioxide) and gases never been alive.	9	17
-It cannot talk, and/or feel, hear, think.	20	13
-It has no eyes, no nose to breathe.	10	7
-We drink it and/or use it.	11	6
-It cannot die but disappears in the soil.	2	3
-Neither dead, nor alive; it is a thing.	2	2
-It is a vapour.	4	3
-It is ice and snow (made of ice and snow).	-	5
-It is a substance.	5	4
-God created it like other things.	6	-
-It has no husband (cannot marry).	3	1
-It does not give birth.	1	2
-Fish lives in it (the house of fish).	2	1
-Nil and unclassifiable.	8	6

Table (4.18) shows the categories of Egyptian and English children's responses to the living objects. It is clear from the table that the percentage of Negatively

Table (4.18)

Percentages (in average) of Egyptian and English children's
explanations for their responses to the living objects

Categories	5 yrs.		6 yrs.		7 yrs.		8 yrs.		9 yrs.		10 yrs.		11 yrs.		Mean	Mean	Mean
	G	E	G	E	G	E	G	E	G	E	G	E	G	E	G	E	T
Positively naturalistic	26.7	33.3	37.0	38.5	44.8	58.3	63.0	66.7	75.0	83.3	88.5	91.7	93.9	90.0	61.3	66.0	63.6
Positively pseudo-naturalistic	33.3	29.6	25.9	19.2	24.1	20.8	14.8	16.7	21.9	13.3	11.5	4.2	6.1	10.0	19.7	16.3	18.0
Negatively naturalistic	10.0	7.4	11.1	7.7	6.9	4.2	3.7	-	-	-	-	-	-	-	4.5	2.7	3.6
Negatively non-naturalistic	3.3	7.4	3.7	7.7	3.4	-	-	4.2	-	-	-	-	-	-	1.5	2.7	2.1
Nil and unclassifiable	26.7	22.2	22.2	26.9	20.7	16.7	18.5	12.5	3.1	3.3	-	4.2	-	-	13.0	12.3	12.7

nonnaturalistic explanations of all the sample was very small. On the other hand the percentage of negatively naturalistic, ^{was} relatively bigger than children's naturalistic responses apart from being right or wrong. Almost the same pattern of distributed percentages into categories could be found in Table (4.19) showing the children's explanations of their responses to the dead objects. More significantly was the high percentage of negatively naturalistic explanations of the children's answers to inanimate items Table (4.20) which could lend support to the conclusion that even when the child's responses was incorrect in terms of right and wrong, his explanation tended to be based on naturalistic causes and not magical or a predominant tendency towards animistic thinking. The three tables also point to the high percentage of the category of nil and unclassifiable explanations particularly at lower ages. Most children who were classified under this category answered the first question correctly, but they were confused in their explanations, which alluded to the fact that they had in mind the distinction between the three concepts tested but their difficulty lay in how to put it into language. Therefore, this category cannot be looked at as a sign of animistic thinking or a category of incorrect responses.

Table (4.19)
Percentages (in average) of Egyptian and English children's
explanations for their responses to the dead objects

Categories	5 yrs.		6 yrs.		7 yrs.		8 yrs.		9 yrs.		10 yrs.		11 yrs.		Mean	Mean	Mean
	G	E	G	E	G	E	G	E	G	E	G	E	G	E	G	E	T
Positively naturalistic	63.7	29.6	44.4	50.0	65.5	62.5	66.7	70.8	84.3	86.7	92.3	87.5	90.9	93.3	68.7	68.6	68.7
Positively pseudo-naturalistic	13.3	22.2	11.1	19.2	10.3	12.5	14.8	8.3	6.3	3.3	3.8	4.2	3.0	-	8.9	10.0	9.5
Negatively naturalistic	16.7	18.5	11.1	-	10.3	4.2	3.7	4.2	6.3	-	-	-	-	3.3	6.9	4.3	5.6
Negatively non-naturalistic	10.0	11.1	14.8	3.8	-	12.5	-	4.2	-	-	-	-	-	-	3.5	4.5	4.0
Nil and unclassifiable	23.3	18.5	18.5	26.9	13.8	8.3	14.8	12.5	3.1	10.0	3.8	8.3	6.1	3.3	12.0	12.5	12.2

Table (4.20)

Percentages (in average) of Egyptian and English children's
explanations for their responses to the inanimate objects

Categories	5 yrs.		6 yrs.		7 yrs.		8 yrs.		9 yrs.		10 yrs.		11 yrs.		Mean	Mean	Mean
	G	E	G	E	G	E	G	E	G	E	G	E	G	E	G	E	T
Positively naturalistic	36.7	22.2	37.0	19.2	34.5	37.5	44.4	41.7	65.6	46.7	65.6	50.0	69.7	33.3	50.5	35.8	43.1
Positively pseudo-naturalistic	6.7	11.1	7.4	15.4	20.7	20.8	14.8	12.5	12.5	13.3	11.5	8.3	9.1	10.0	11.8	13.1	12.4
Negatively naturalistic	23.3	22.2	14.8	23.1	20.7	16.7	25.9	20.8	9.4	16.7	7.7	25.0	6.1	36.7	15.4	23.0	19.2
Negatively non-naturalistic	13.3	25.9	18.5	15.4	10.3	12.5	3.7	16.7	3.1	13.3	7.7	4.2	9.1	6.7	9.4	13.5	11.5
Nil and unclassifiable	20.0	18.5	22.2	27.0	13.8	12.5	11.1	8.3	9.4	10.0	7.7	12.5	6.1	13.3	12.9	14.6	13.8

4.5 DISCUSSION

When the results were viewed as a whole, the first hypothesis that animism is a generally universal characteristic of the child's cognitive development which decreases with increasing age was clearly unsubstantiated. Occurrence of animistic responses of the whole sample was so little in most cases (ranged from 1.8 per cent for 'crocodile' to 35.5 per cent for 'water') that they might be less than the animistic thinking percentage of educated adults recorded in the finding of Simmons and Goss (1957). However, even in the high proportions of what seemed to be animistic responses (clock, water), the children gave a higher percentage of natural explanations for their wrong answers.

Examples:

1- Is the candle alive, dead or has never been alive?

- *It is alive.*

- Why do you think so?

- *Because it dies when burning.*

2- Is the clock alive, dead or has never been alive?

- *It is alive.*

- Why do you think so?

- *It is ticking.*

3- Is the crocodile alive, dead or has never been
alive?

- *It is alive.*

- Why do you think so?

- *It is made of wood, and wood comes from the tree,
tree is alive, so the crocodile must be alive.*

Furthermore, the highest percentage of this animistic thinking was given by the children of highest age level which did not corroborate the claim that there is a definite age at which animistic thinking occurs. The confusion between living, dead and inanimate objects shown by older children in specific objects (clock and water) was due to their individual tendency to elicit their answers from their own cultural background and scientific knowledge rather than to have a prevailing attitude of animistic thought. Water was seen as alive on the misunderstanding of the scientific formula that it contains oxygen and carbon dioxide and it was seen as inanimate on the basis of the same formula. It was alive because it was a liquid while it was inanimate because of being liquid. Water was held as alive because 'without it we die', and because 'we drink it'. It was dead to some children and inanimate to others.

As has been previously stated, movement was not the only criterion by which the child attributes life to inanimate objects as Piaget (1929) suggests about the second stage of development at which 'life is assimilated to movement':(1)

Zimm (8;1) 'Is a stone alive? - *Yes.* - Why? - *It moves (il marche).* - When does it move? - *Some days, sometimes.* -

How does it move? - *By rolling.* (1)

Although a small number of children ascribed life to the water and the clock on the basis of movement, none of the insignificant number of the children who saw the stone as alive mentioned movement as a criterion. There was only one child at age 8 in the English sample who stated that the stone was alive and his answers were as follows:

Jacob(8;9) - Is the stone alive, dead or has never
been alive?

- *It is alive.*

- Why do you think so?

- *Because it will break if you throw it.*

Thus there was no evidence that movement is the only criterion by which the child of the first, second, or third stages attributed life to inanimate objects. This finding corroborates the conclusion of King (1961) that movement was recognized as not the sole criterion of life(2), and if movement happened to be a criterion of life in the child's mind, it occurred at all ages and not only at the Piagetian second and third stages. Consequently, the results did not support Piaget's and other investigators' claim of the universality of the four stages of development.

1- *Ibid.*

2- King, 'The development of scientific concepts in children', p. 16.

On the other hand, the concepts of life and death tended to correlate in the minds of Egyptian and English children and to reach the level of accuracy with increasing age. All children were consistent in their responses to living and dead objects (Tables 4.5 and 4.6).

There was a statistically significant correlation, (at the $p < 0.001$ level), revealed through Kruskal-Wallis 1-Way Anova, between the age factor and response categories. Older children demonstrated a general trend to give more right responses to living and dead objects (e.g. the flower where $H = 131.38$, $df = 3$, and the dead frog where $H = 47.363$, $df = 3$). This general trend was well illustrated by the obvious increase in Kruskal-Wallis mean rank scores of age groups with the increase of correct answers.

Despite this gradually increasing accuracy in the concepts of life and death, it did not appear that it moved in four stages of development because in some cases younger children performed better than older children. As a whole, the second hypothesis that the child's concepts of life and death move towards accuracy with the same four stages given by Piaget (1929) was partly corroborated, and partly should be modified (according to the results obtained) to be:- the child's concepts of life and death move towards accuracy with increasing age and without definite ages for stages of development.

As a result of the non-substantiation of the first hypothesis, the third hypothesis that the Piagetian four developmental stages of the child's animistic thinking are universal in the sense that they manifest themselves in both degree and sequence among the children of both England and Egypt could not be borne out. There was no evidence either in the Egyptian sample or in the English sample to support that animism was a characteristic of the thinking structure of the child (Table 4.7). Besides there was no evidence of the existence of the four developmental stages suggested by Piaget. Therefore, the issue of the universality of animistic thinking of the child was called into question by the results, which give support to the findings of Huang and Lee (1945), King (1961), Smeets (1974), Smith and Dougherty (1965), and other investigators.

From the results of the comparison between Egyptian boys and girls on one side, and between English boys and girls on the other, the fourth hypothesis that gender does not play an important part in the child's attribution of life and death to inanimate objects was obviously proven. Although there were apparent differences between boys and girls of both cultures in percentages, these differences tended to be insignificant when tested statistically. So, gender did not seem to be a significantly contributing factor in the children's variations of performance. On the other hand, cultural and environmental variables

tended to be more influential in determining the children's patterns of response to many objects. This substantiated the fifth hypothesis that cultural and environmental factors play a more significant role than gender in the child's attribution of life and death to inanimate objects.

CHAPTER FIVE

THE TERM CROSS-CULTURAL AND REVIEW OF LITERATURE

"One wonders in which direction knowledge flows :
from uni-cultural knowledge of man to a better cross-
cultural understanding or from cross-cultural knowledge
to more valid uni-cultural theories?"

(Malpass, 1977)

* * * * *

5.1 INTRODUCTION

This chapter aims at reviewing the literature approving and disproving Piaget's theory in general and its universality in particular. Whenever Piagetian stages of the child's development are mentioned, Piaget stands for a bone of contention in the criticisms of modern psychologists and educators as well. Perhaps, this dispute concerning Piaget's findings and contributions provides clear evidence that he is a genius on the basis that in all fields of knowledge geniuses are always doomed to be subject to controversy. Margaret Boden (1979) illustrates and justifies this fact by holding the view that Piaget is unquestionably a modern master despite all the criticism that can objectively be directed to him.(1) Viewed in the light of his comprehensive systematic structure, his mistakes are generally significant. The understanding of these mistakes must be the most appropriate response to them, which is prior to any process of castigating or even correcting them.(2) The reason is that psychologists, biologists and epistemologists not only discuss each other's questions but find it fruitful to borrow - even if they have to adapt each other's answers.(3)

The studies and references reviewed in this chapter are intended to be examples only and not an exhaustive survey

1- Boden, *Piaget*, p. 28.

2- *Ibid.*, p. 22.

3- *Ibid.*, p. 29.

because in such a vast subject as Piaget's contributions, it is not possible to trace and accumulate all works of criticism in one chapter of a thesis. So it is meant to be a general survey of the literature on cross-cultural studies dealing with the following points:

- The definition of the term cross-cultural as distinct from terms like intra-cultural and cross-national,
- A classification of cross-cultural studies,
- Variables that influence cognitive development, and
- A review of cross-cultural studies done in different cultures and their conclusions following as closely as possible the lists introduced by Modgil (1976)(1), and Dasen and Heron (1981)(2)

It is noticeable from the lists that both lists do not include any study done in Egypt, so this chapter will include some studies carried out in Egypt by Waines (1984), Abdel-Zahar (1984), Shoeib (1982), Rashwan (1982), Mustafa (1980), Boulos (1980), Ali (1979), and Mahmoud (1979). The references used are as relevant as possible to the main interests and objectives of the present study in illustrating and applying Piaget's theory to the Egyptian children as compared to the English children.

- 1- S. and C. Modgil, *Piagetian Research: Compilation and Commentary*. NFER Publishing Company Ltd., Windsor, Berks, 1976, Vol. 8, p. 17
- 2- P.R. Dasen and A. Heron, 'Cross-cultural Tests of Piaget's Theory', p. 303.

Moreover, it will be noticed that Dasen's studies in general are often referred to with special concentration on Dasen and Heron (1981). The reason for that arises, presumably, from these issues:

Dasen's studies constitute an authorized source of one of the most objective scholars of Piaget whose writings are recommended by most critics and influence most researchers,

Dasen and Heron's (1981) article is fairly recent and comprehensive in the sense that it summarises the majority of the data of recent researches given by many other authors and their co-workers,

Dasen demonstrates conclusions he has found since he began writing on the subject, and above all, he illustrates a great deal of other empirical studies, and

Dasen assumes comparability of results and makes no judgment on the value of the individual studies.

5.2 THE TERM "CROSS CULTURAL"

From the traditional point of view, N. Frijda and G. Jahoda (1966) draw the definition that cross-cultural study is the one which contains a comparison between a Western industrial culture and a pre-literate tribal one. They exclude from the title "cross-cultural" any study that is preoccupied with sub-cultural groups such as social classes, regional differences as between England

and Scotland, or cross-ethnic work within the same culture as in the case between American Whites and Blacks.(1)

According to this definition, a distinction must be drawn between cross-cultural and intra-cultural. On the other hand the term cross-national is thought to be a reference to researches done only within Western nations. Thus, a comparison made between the U.S. and Germany is not considered cross-cultural whereas the term is applied to a study between the U.S. and Japan despite the fact that all three countries are highly industrialized.

Nevertheless, it is very hard to find a culture that has not been influenced by Western ideas or technologies. This problem leads one to regard cross-national studies as cross-cultural as long as they do not involve fundamental contrasts in methodology.(2)

In other words, as Price-Williams (1969) thinks, cross-cultural is ascribed to studies which are concerned with two or more cultures or societies, while intra-cultural deals with researches made in the one culture.(3) Both cross-cultural and intra-cultural are two types put together when researching for factors that pertain to culture. From this view, he concludes that cross-cultural research is an extension of intra-cultural

- 1- N. Frijda and G. Jahoda, 'On the scope and methods of cross-cultural research', *International Journal of Psychology*, Vol.1, 1966, pp. 110-111.
- 2- Ibid., p. 110.
- 3- Price-Williams, *Cross-Cultural Studies*, Penguin, Middlesex, 1969, p. 13

group comparison, and that the term cross-national as confined to studies within Western nations is somewhat artificial.(1)

Deregowski (1980) approves and supports the above mentioned definition of the cross-cultural studies made by Price-Williams when she identifies their purpose with that of intra-cultural studies of perception. The purpose is to explain the nature and mode of operational perceptual mechanisms. Cross-cultural studies uniquely contribute to extend the range of individuals concerned in such a way that proves that the phenomena observed are certainly characteristics of human behaviour.(2)

Barbara Lloyd (1983), in her attempt to evaluate Piaget's contribution to cross-cultural research, traces and examines the history of cross-cultural studies that made use of Piaget's theory. After giving a clear historical survey of cross-cultural psychology as distinct from anthropology and laboratory psychology and as lying somewhere between both, she indicates that cross-cultural psychology is considered a "meta-method" which takes all areas of psychology as its domain. She refers to the *Handbook of Cross-cultural Psychology* (1980) as a support to this modern definition which differs from that

1- *Ibid.*, p. 13.

2-Jan Deregowski, 'Some Aspects of Perceptual Organization in the Light of Cross-cultural Evidence', in *Studies in Cross-Cultural Psychology*, Vol. 2., ed. N. Warren, Academic Press, London, 1980, p.51

mentioned above.(1)

Brislin, Lonner and . Thorndike (1973) suggest a 'working definition' which could be subject to modification in the future because of considering two main respects:

- 1- the interrelations of cultural forms, and
- 2- variability and the individual.

Their definition is that:

Cross-cultural psychology is the empirical study of members of various culture groups who have had different experiences that lead to predictable and significant differences in behaviour.(2)

On the other hand, they identify some problems or challenges that the researcher in cross-cultural psychology has to face in gathering and interpreting the necessary data. These problems are:

- 1- gaining access to the culture,
- 2- obtaining samples of people equivalent to respondents from comparison studies in the researcher's own culture,
- 3- writing meaningful questions and translating them,
- 4- ascertaining that the questions written in one language are equivalent in meaning to those in another,
- 5- assuring that any additional tools of research (tests equipment) are not merely a momentary and strange

- 1- Barbara Lloyd, 'Cross-Cultural Studies of Piaget's Theory', in *Jean Piaget: An Interdisciplinary Critique*, ed. S. & C. Modgil and G. Brown, Routledge & Kegan Paul, London, 1983, pp. 27-29.
- 2- R. Brislin, W. Lonner and R. Thorndike, *Cross-Cultural Research Methods*, J. Wiley and Sons, London, 1973, p. 5.

imposition on subjects,

6- interviewing people who may be much more hostile or courteous (both leading to biases) to researchers than respondents from Western countries, and

7- developing reasons for the obtained data as a function of all cultures under study rather than the researcher's own unicultural biases.(1)

Nevertheless, Brislin and co-workers believe that it is very difficult to have a widely acceptable definition of cross-cultural psychology, and even their own definition will undoubtedly be modified and enlarged in the future.

Price-Williams (1975) considers the problem of accepting an accurate definition of the term 'cross-cultural' more complex than it might seem to be at first sight. Since the term should be confined to a comparative study of two or more cultures, then studies investigating one culture are excluded and as a result he maintains that "if this definition is held to be accurate, only by secondary extension can the findings in one culture be assimilated into the general area of 'cross-cultural' psychology".(2)

In another place Price-Williams (1969) argues that a clearly prominent cultural factor that is put to the test in researches is the decisive element in any experiment or

1- *Ibid.*, p. 4.

2- D. Price-Williams, *Explorations in Cross-Cultural Psychology*, Chandler and Sharp Publishers, San Francisco, 1975, p. 3.

observation to be qualified for cross-cultural or even intra-cultural inclusion and to influence some psychological mechanism, and that is why he states that, "The mere fact that a research is done in Mexico, Zambia, Thailand or wherever, does not of itself make the investigation amenable to cross-cultural analysis".(1)

The factors which influence psychological processes and which are decisive elements in any study to be regarded as cross-cultural are determined by Price-Williams as follows:

- the nature of the physical environment,
- type of living quarters,
- methods of production,
- degrees of literacy,
- exposure to the world of print and pictorial productions,
- family types,
- child-training techniques, and
- varieties of organization in social, economic and religious spheres.(2)

With reference to the last factor mentioned above, Price-Williams, although he admits that as long as cross-cultural researches go on, there is still a great number of factors that influence psychological processes to be explored, seems to overlook the 'political' sphere.

- 1- D. Price-Williams, in his introduction to *Cross-Cultural Studies*, pp. 14-15.
- 2- *Ibid.*, p. 12.

This political sphere is though to be one of the important factors that influences concepts especially in the moral stage in most of the countries whose political systems depend on political indoctrination, the political sphere could be added to Price-williams' list (Shayer and Adey, 1981)(1) and Brislin, Lonner and Thorndike, (1973)(2)

Furthermore, Dasen and Heron (1981) define these factors which influence psychological development as:

- urbanization,
- acculturation,
- schooling ecocultural relevance,
- cognitive ambience, and
- individual differences.(3)

The system of student evaluation for university admittance is another factor which could be added by Dennis Hocevar, Maria Denello, and Nabil Abdel-Zahar (1984).(4)

In this respect, Dasen (1972a), in his summary written while he was a research scholar at the Australian National

- 1- M. Shayer and P. Adey, *Towards a Science of Science Teaching: Cognitive Development and Curriculum Demand*, Heinemann Educational Books, London, 1981, p. 141.
- 2- R. Brislin, W. Lonner and R. Thorndike, *Cross-Cultural Research Methods*, p. 5.
- 3- P.R. Dasen and A. Heron, 'Cross-Cultural Tests of Piaget's theory', p. 296
- 4- D. Hocevar, M. Denello and N. Abdel-Zahar, 'A Paradigm for Examining the Psychometric Characteristic of Cross-Cultural Advances in Test Anxiety', *Arab Youth*, No. 909, Cairo, 1984, p. 10. (This study will be published in *International Society for Test Anxiety Research*, Vol. 4, 1985).

University, tries to classify the studies done on cross-cultural implications of Piaget's theory. He divides these studies into two main categories; 'descriptive' and quasi-experimental'. Descriptive studies attempt to verify Piaget's stages in non-Western cultures while quasi-experimental studies are concerned with linking cognitive performance to specific cultural factors.(1)

Ashton (1975) holds the view that the effects of schooling draw much more attention than social influences do upon cognitive development. However, she presents some issues which are particularly relevant to any discussion of the influences of social factors on cognitive development. These issues include:

- The effect of social goals on the development of egocentrism,
- The differential effects of social environment upon various cognitive processes,
- The effect of culture on moral development,
- The effect of the cultural concept of reality on cognition, and
- Peer-group effects on cognitive development.(2)

- 1- P. R. Dasen, "Cross-Cultural Piagetian Research: A Summary", *Journal of Cross-Cultural Psychology*, Vol. 3, No. 1, March, 1972, p. 23.
- 2- P. T. Ashton, "Cross-Cultural Piagetian Research: An Experimental Perspective," *Harvard Educational Review*, Vol. 45, No. 4, November 1975, p. 487.

The importance of delineating factors which are specific to individual development and factors which are specific to the society under investigation in a comparative study is stressed by Piaget (1974) so as to produce unexpected results. Piaget classifies these factors into four groups according to the types of relations between the individual and the social environment. these four groups are:

- Biological factors which are linked to the epigenetic system,
- Equilibration factors seen as an autoregulation closer to homeostasis than to homeorhesis,
- Social factors of interpersonal coordination which occur during the whole of development, and
- factors of educational and cultural transmission constituted by traditions and education which vary from one culture to another.(1)

5.3 CROSS-CULTURAL STUDIES: A PROBLEM

Cross-cultural researches are not to be confined to a certain age-range development. Their importance lies in the fact that they take in not only child development but development in general including the final adult stages.

- 1- Jean Piaget, 'Need and Significance of cross-cultural studies in genetic psychology', in *Culture and Cognition: Readings in Cross-Cultural Psychology*, ed. J.W.Berry and P.R.Dasen, Methuen, London, 1974, pp. 300-303.

However, the growing literature of cross-cultural studies dealing with Piaget's theory and interested in verifying the universality of its stages of cognitive development (Modgil and Modgil, 1976)(1) is very extensive to the extent that its very hard to cover it fully (Dasen and Heron, 1981).(2)

Nevertheless the belief that there is still much work to be done before passing any judgment on Piaget's theory in general and its universality in particular is often emphasised by Dasen (1972a)(3), Dasen and Heron (1981).(4)

Dasen (1972a) argues that in most cases the qualitative aspects of Piaget's theory are substantiated while the rate of operational development is affected by cultural factors. He thinks that the quasi-experimental research has yet to advance enough to link cognitive behaviours to cultural factors. In this respect, Dasen points out that the universality of the sequential succession of stages described by Piaget and the ages at which they appear have been obscured by failing to distinguish three different interpretations of Piaget's stages:

(1) The succession of the three global stages: sensori-motor, (pre-operational), concrete operational and

- 1- Sohan and Celia Modgil, *Piagetian Research: Compilation and Commentary*, Vol. 8, p. 70.
- 2- P.R. Dasen and A. Heron, 'Cross-cultural Tests of Piaget's theory', p. 303.
- 3- "Cross-cultural Piagetian Research: A Summary, p. 35.
- 4- Dasen and Heron, Op.Cit., p. 335.

formal,

(2) The sequences through which the same operational structures are applied to different concepts such as the (horizontal decalages) of the conservation of quantity, weight and volume,

(3) The sequence of substages of any particular test.(1)

Dasen concludes that all cultural researches of Piaget's stages on individual tests give evidence that some or all subjects attain the stage of concrete operations, although usually at a later age than middle-class Europeans. He ascribes some qualitative differences to the fact that environmental factors may be more important than Piaget seemed to hypothesize in his earlier writings.(2) From this, he suggests that descriptive studies are in favour of the cross-cultural validity of Piaget's theory while quasi-experimental research is needed in order to link the qualitative and quantitative aspects of operational development to specific cultural factors.(3)

The same idea is stressed again by Dasen (1977a) when he indicates the idea of the immaturity of cross-cultural Piagetian psychology, and describes it as a relatively recent development which is still at the stage of concrete

1- Dasen, Op.cit., p. 25.

2- Ibid., pp. 33-34.

3- Ibid., p. 35

data collection.'(1)

On the other hand, the question of the universality of Piagetian cognitive structures is supported by Dasen (1972b, 1974) and Dasen and Heron (1981). Dasen always stresses that the development of the sensorimotor and concrete operational stage is universal at least from the qualitative point of view. Moreover, Dasen and Heron (1981) proceed to confirm the remark that in cross-cultural investigations of the Piagetian theory, some investigators concentrate on the qualitative generalities and therefore substantiate its universality, whereas others are concerned with quantitative differences and thus claim to disprove the theory.(2) However, Dasen and Heron come to the same conclusion referred to in most of Dasen's writings on the subject believing that there is still much work to be done before passing any judgment in favour or against Piaget's theory on the ground that there are many unresolved methodological issues and essential data are not yet available.(3)

Dasen's view is supported by Oppen (1977)(4) Super

- 1- P. R. Dasen, *Piagetian Psychology: Cross-Cultural Contributions*, Gardner Press, New York, 1977, p. 1.
- 2- 'Cross-cultural Tests of Piaget's Theory', p. 306.
- 3- Ibid., p. 335.
- 4- Sylvia Oppen, 'Concept Development in Thai Urban and Rural Children', in *Piagetian Psychology*, ed. P.R. Dasen, 1977, p. 121.
- 5- Charles M. Super, 'Cross-cultural Research on Infancy', in *Handbook of Cross-cultural Psychology: Developmental Psychology*, ed. H. C. Triandis and A. Heron, 1981, Vol.4, p. 41.

(1981)(5) and Price-Williams et al (1977).(1)

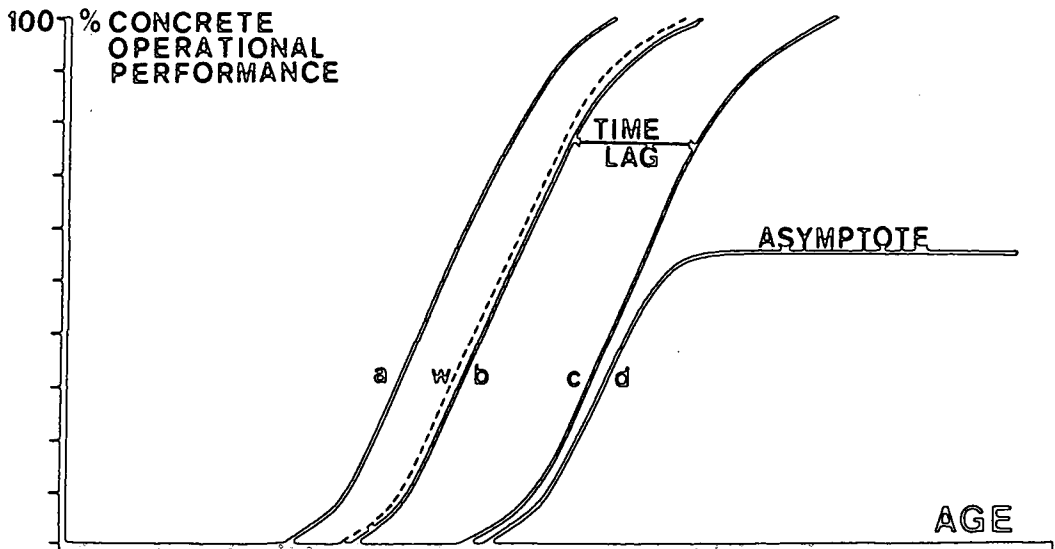
Reviewing the literature of cross-cultural studies, especially those which illustrate quantitative differences in the attainment of concrete operations, Dasen and Heron obtain developmental curves which show the rate of conceptual development in the sample as a whole rather than in an individual child. These curves, which are shown in Fig. 5.1, do not essentially differ from the curves given by Dasen (1972a). Dasen and Heron assume that curves of types (a), (b), and (c) do not present any problem to Piaget's theory but rather reflect 'the fact that the stages ... are accelerated or retarded in their average chronological ages according to the child's cultural and educational environment (Piaget, 1970, p. 721)'.(2) On the other hand, curves of type (d) which show that some individuals do not attain the concrete operational stage present a problem to the theory. This curve is reported in Greenfield's (1969) study concerning the unschooled Wolof subjects, and found in the rural samples with almost every task in the studies by (Mohseni, 1966; Peluffos, 1967; Poole, 1968; Kiminyo, 1977; Oppen, 1977) in general and in the Ebrie's sample on the concept of 'horizontal'ity', and in Central Eskimo and Australian Aboriginal subjects on the conservation of quantity in

- 1- D. Price-Williams, Hammond, Edgerton, and Walker, 'Kinship Concepts Among Rural Hawaiian Children', in *Piagetian Psychology*, ed. P.R. Dasen, 1977, p. 332.
- 2- Quoted from Dasen and Heron, "Cross-cultural Tests of Piaget's Theory", 1981, pp. 311-312.

Fig. 5.1

Theoretical development curves representing the percentage
of concrete operational performance over age
(from Dasen and Heron, 1981)

Curve (W) is assumed to be the developmental curve for a sample of children from a Western, technological background, on any particular Piagetian task of the concrete operational stage. Curves (a), (b), (c), and (d) are possible developmental curves from cross-cultural studies.



If the same test is applied to a different cultural group, several possibilities exist:

- (a) The concept develops earlier, or more quickly.
- (b) The concept develops at the same time as in European children.
- (c) The concept develops later, or more slowly; there is a "time-lag", or retarded development; all children however, eventually reaching concrete operational thinking.
- (d) The concept starts to develop at the same time or later, but the curve is asymptotic - it flattens out at the higher ages: some children, and even adults, do not reach the concrete operational stage.(1)

(1) Ibid. pp.311, 312

Dasen's (1975a) study in particular.

5.4 VARIETY OF INFLUENTIAL VARIABLES

In her investigation of the influence of the intra-cultural variables of class and work experience on the development of economic concepts among Egyptian children, Nahid O. Waines (1984) uses a sample of 180 Egyptian boys. This sample is divided into 3 groups: (1) a lower-class working group, (2) a lower-class nonworking group, and (3) an upper class group. Each group is subdivided into 2 age groups (7-9-year-olds and 11-13-year-olds) with 30 subjects in each. She applies ten questions used by Danziger (1958) in his study of Australian children in addition to two of her own:

- What is the importance of money?
- Should everyone have money?

Waines categorizes the responses in the manner of Danziger, 1958; Furth, 1978; Hong Kwang and Stacey, 1981; and Stacey, 1982.(1) She concludes that:

1. Cross-cultural convergence is noticed through the existence of a developmental pattern in economic concepts among Egyptian children,
2. Cultural environment dominantly affects all groups

1- Nahid Waines, "Development of Economic Concepts among Egyptian Children", *Journal of Cross-Cultural Psychology*, vol.15 No.I. March, p. 53.

of children; socioeconomic concepts are influenced by common religious codes,

3. Some important variations exist in the age at which certain concepts are attained among children who belong to different socioeconomic groups, and
4. The effect of the work experience, while not statistically significant as a variable, was qualitatively noted in certain concepts.(1)

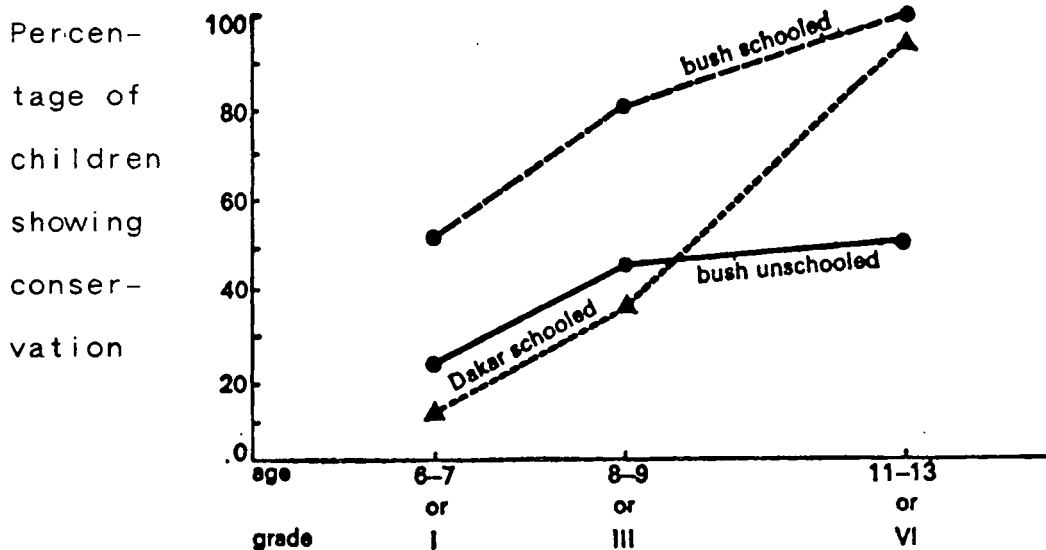
These conclusions are indicative of the notion that the socioeconomic variable is more significant than work experience as a source of conceptual variation among different subcultural groups. Similarly, Pauline Jones (1976) asserts the socioeconomic variable as positively influential in the study administered in Newfoundland and Labrador. Her results indicate a systematic decrease of spatial-perceptual ability moving within a lower-class segment of society from urban families to families in small or isolated communities. Jones also emphasises the importance of other relevant factors in the children's development such as the quality of schooling, the availability of television and other general indices of intellectual stimulation.(2)

1- Ibid., pp. 62-63.

2- Pauline Jones, "Maternal Socialization Practices and Spatial-Perceptual Abilities in Newfoundland and Labrador", in *The Developing Individual in a Changing World*, (vol.I) ed. by K. Friegel and J. Meacham, 1976, pp. 347-354.

Greenfield (1969), in a study of conservation conducted on Wolof children in Senegal, tried to find and analyse differences in cognitive functioning of what anthropologists call 'primitive minds'.(1) Experiments have been carried out on schooled and unschooled children and the data are presented graphically in Figure 5.2 which demonstrates the percentage of children of different backgrounds and age groups exhibiting conservation of a continuous quantity.

Fig. 5.2



Percentage of children of different backgrounds and ages exhibiting conservation of a continuous quantity (according to Greenfield, 1969)

1- P. Marks Greenfield, 'On Culture and Conservation'. in *Cross-cultural Studies*, ed. D.R. Price-Williams, 1969, pp. 211-212.

Greenfield concludes that:

1- Traditional belief system such as action-magic strongly influenced the children's interpretation of transformations - this is also noticed by Vernon (1967) in his study conducted in Uganda,

2- Schooling is a fundamental cultural influence on the operational development: 'there is a wider gap between unschooled and schooled Wolof children from the same rural village than between rural and urban school children. By the eleventh or twelfth year virtually all the school children have achieved conservation. Only about half of those not in school have done so'(1),

3- Culturally variable conditions affect the attainment of conservation.

4- In terms of grade level, the Senegalese figures are almost identical to the Western ones, although the Wolof children are behind in terms of chronological age,

As regards the last finding, it is supported by Prince's (1968) conclusions in his study conducted in the Territory of Papua and New Guinea. In his pilot survey of the development of basic physical science concepts, he tried to find out the influence of both environment and inheritance on conceptual development. The test items covered concepts of length and displacement, conservation

1- Ibid., p. 243.

of quantity, weight, area and volume and the view of density in relation to the nature of the substance. He found out that the responses showed the pattern of Piagetian stages, although conservation was not attained until much later than in Western European culture. Because the survey was carried out in three distinct geographical and cultural regions of the territory of Papua and New Guinea, he found variations between the districts which made it difficult to estimate the difference in terms of age, but when performance was measured against school grading, he found no great difference among the three districts tested. This is shown graphically in Figures 5.3-5.6.(1) Prince reported that as far as inheritance was concerned, it did not affect performance despite the fact that there were large differences in the inheritance characteristics of the various groups tested. On the other hand, environment was a very important factor in determining the progress of conceptual development.(2) He found also that school grade is more significant than calendar age in developing concepts which involve the conservation of physical quantities, and that English education is more significant in relation to physical concepts than total years of schooling.(3)

- 1- J.R. Prince, 'The Effect of Western Education on Science Conceptualisation in New Guinea', *British Journal of Educational Psychology*, 1968, 68, pp. 65-66.
- 2- Ibid., p. 73.
- 3- Ibid., p. 64.

The Results of Prince (1968)

FIG. 5.3 CONSERVATION OF SUBSTANCE BY SCHOOL GRADE

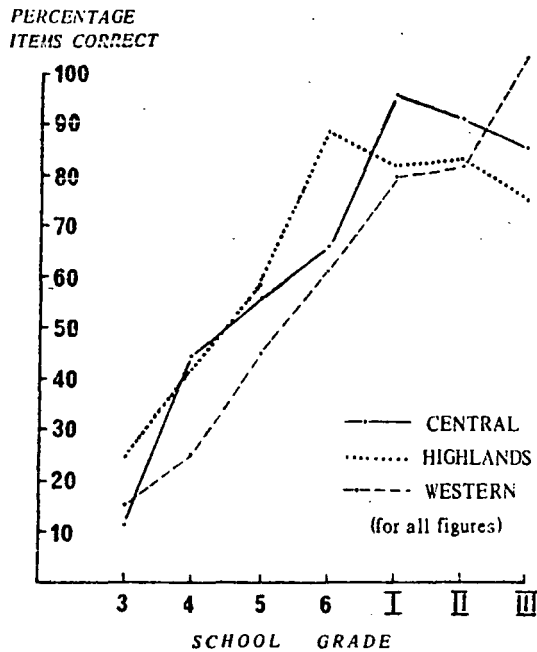


FIG. 5.4 CONSERVATION OF SUBSTANCE BY CALENDAR AGE

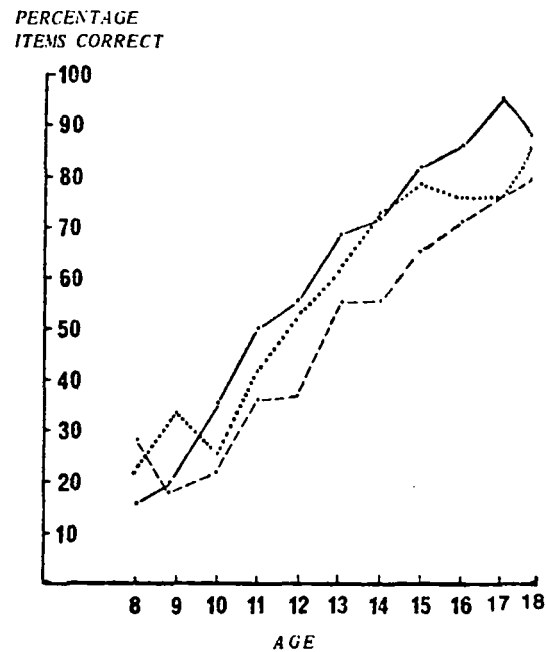


FIG. 5.5 CONSERVATION OF AREA BY SCHOOL GRADE

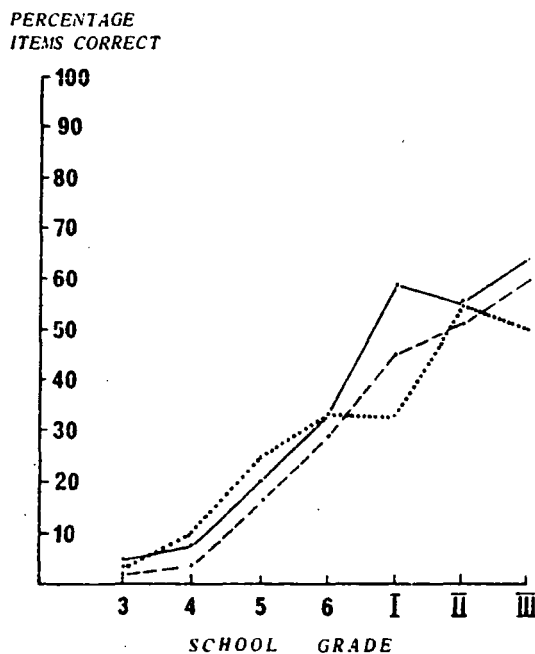
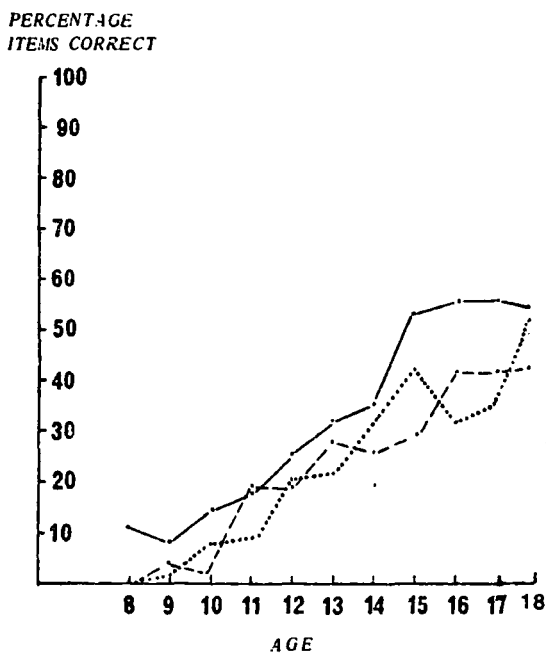


FIG. 5.6 CONSERVATION OF AREA BY CALENDAR AGE



A similar result was obtained by Price-Williams (1969) in his field research among the children of the Tiv tribe in Central Nigeria. Price-Williams faced the same difficulty mentioned above by Prince in ascertaining the child's exact chronological age because the study was carried out among bush or primitive children.(1) He tried to overcome this problem by relying on physical characteristics of height, teeth and verbal fluency. Five groups each of which constituted nine illiterate children were tested on the question of conservation of continuous and discontinuous quantities in which Piaget's techniques were followed as closely as possible. Earth and nuts were used as examples of continuous and discontinuous quantities respectively. Results indicated that the progression of the idea of conservation paralleled that found in European and other Western children by previous investigators, that is to say, he found the difference between Tiv and European children hardly noticeable in attaining the conservation of continuous quantities (earth), discontinuous quantities (nuts) and Number.

In another study, Price-Williams (1962)(2) recognised that some differences were due to length of schooling in tasks which required classificatory strategies. He

- 1- D.R. Price-Williams, 'A Study Concerning Concepts of Conservation of Quantities Among Primitive Children', *Cross-cultural Studies*, ed. Price-Williams, 1969, p. 203.
- 2- Price-Williams, 'Abstract and Concrete Modes of Classification in Primitive Society', *British Journal of Educational Psychology*, 1962, 32, pp. 56-61.

emphasised the familiarity of materials as an influence on the level of performance. Nigerian children performed at a higher level of operativity relative to English children in classifying and abstracting the common features of indigenous plants. Yet, the Nigerian children performed at a lower level of Piagetian operativity with animals which were considered to play a less meaningful role in everyday life.

Another point of view is held by Ashton (1975) who maintains that:

The failure to demonstrate generalizability of conservation and formal operational thought across materials and situations (Feldman, 1974) leads one to question the significance of the concept of conservation as well as the notion of generalized cognitive structures. To determine the relationship among conservation tasks and other measures of intellectual development, studies investigating interrelationships among a variety of tasks measuring different processes are required. The Campbell and Fiske (1959) multitrait-multimethod approach is appropriate here ... (1)

Ashton, however, claims that cross-cultural studies possibly propose a developmental lag for acquisition of conservation in non-Western, non-industrialized cultures. These studies do not clarify the reason behind this lag; is it due to a failure of the assessment method or because there are real cognitive differences between cultures? (2)

- 1- P. T. Ashton, 'Cross-cultural Piagetian Research: An Experimental Perspective', p. 479.
- 2- Ibid., p.483.

The most significant suggestion Ashton makes in her paper is the array of points leading to an effective cross-cultural research. These points are:

- A comprehensive study of the cultures concerned should be done by anthropologists and linguists helping to determine appropriate techniques and identifying cultural factors that may influence cognitive development,
- These data should be used in creating hypotheses derived from existing cognitive theory,
- Large and thoroughly representative sample,
- Examination of complex interactions should be permitted in designs,
- Problems should deal with significant theoretical issues rather than with mere efforts to validate age trends, and
- Studies should include many experimentations to give significant insights into the issues examined.(1)

In explaining why the application of research design to Piagetian questions in a cross-cultural context should be complex, Ashton claims that this opens up interesting possibilities for significant contributions to developmental theory. With reference to designs, various cultural settings need designing studies which enable researchers to produce the natural experiment that represents cognitive developmental processes as they actually operate in the environment.

1- Ibid., pp. 501-502.

In a cross-cultural study carried out in Egypt, Brazil and the U.S., Hocevar, Denello and Abdel-Zahar (1984) find that test anxiety has more influence on the conceptual development of the Egyptian secondary school students than it has on both Brazilian and American ones' conceptual development. This difference the researchers find is due to factors such as systems of education. In this study the researchers used a new measuring design with the help of Confirmatory Factor Analysis.(1) Grade three of the secondary school in Egypt is the only measure according to which the Egyptian student can be accepted in the university and as a result the student suffers a great deal of nervous tension as he wishes to get high marks. While in the other two countries the cumulative achievement of the three secondary years is taken to evaluate the student in addition to psychological and academic tests of qualification for the university. English children , like their Egyptian counterparts, have to pass their A Level Exams for admission to a university.

The influence of systems of education on cognitive development is clearly emphasised by Rashwan (1982), who carried out a comparative study on 13-16 year old Egyptian and English children as regards the children's understanding of biological concepts without application

- 1- D. Hocevar, M. Denello and N. Abdel-Zahar, 'A Paradigm for Examining the Psychometric Characteristic of Cross-cultural Advances in Test Anxiety', *Arab Youth* , No. 909, Cairo, 1984, p. 10.

to any particular theory of cognitive development.(1) The role of educational system in the cognitive development is also stressed by Al-Fakhri (1977)(2), examination and student evaluation.

In an attempt to design part of a curriculum suitable for East Javanese children of primary school age in the subject areas of Western European mathematics and science, Christine Deer and Max Kelly (1982) used the conservation forms of number, quantity and length on a sample of 144 Malang primary school children characterised by age, sex and grade. The results provided were subjected to sequence analysis derived from the ordering theory approach described by Krus, Bart and Airasian (1975) but extended and developed by Bailey (1978).(3)

According to the results described in Table 5.1, Deer and Kelly came to the conclusion that the sequences emerging were not the same as those described by Piaget and the Genevans as universal, and they recommended that this conclusion must be taken into consideration for

- 1- Soheir S. Rashwan, "A Study of Learning and Understanding of Certain Biological Concepts Among Egyptian School Pupils of 13-16 Years of Age", unpublished Ph.D. Thesis, University of Reading, 1982.
- 2- S. Al-Fakhri, 'The Development of the Concept of Speed Among Iraqi Children', in *Piagetian Psychology : Cross-cultural Contributions*, ed., P.R. Dasen, 1977, p. 214.
- 3- C. Deer and Max Kelly, 'Piagetian Tasks for Curriculum Construction in Java Using Sequence Analysis', *Journal of Cross-cultural Psychology*, Vol. 13, No. 2, June, 1982, p. 220.

Table 5.1
Number of Children Succeeding in Tasks by School
Grade and Sex (from Deer and Kelly, 1982)

Class (Sex)	Length						Number				Quantity		
	L1	L2	L3	L4	L5	ΣL^a	N1	N2	N3	ΣN^a	Q1	Q2	ΣQ^a
1 (Male)	1	1	3	5	2	1	3	2	2	1	5	5	5
1 (Female)	1	1	3	4	2	1	3	3	3	3	1	4	1
4 (Male)	8	7	7	8	7	7	4	3	3	3	9	9	8
4 (Female)	5	5	5	6	6	5	7	7	4	4	13	13	10
6 (Male)	14	12	13	11	11	10	12	11	14	11	16	15	15
6 (Female)	14	16	16	16	15	11	18	16	16	16	17	17	14
Totals	43	42	47	50	43	35	47	42	42	38	61	63	53

a. ΣL , ΣN and ΣQ mean those who passed all subtests for each of the conservations.

educational planning at least in Java.(1)

On the other hand they suggested two aspects of Piaget's theory which needed to be confirmed in the cross-cultural setting, especially if the data collected were to be used in educational planning or process. These were:

- 1- the order of appearance of success in the achievement of the tasks Piaget used as developmental signposts is the same across cultures, and
- 2- the way in which the "signpost" begins to appear is also similar across cultures.(2)

Greenfield's (1969) conclusion that schooling is a major influence on children cognitive development is supported by Ciborowski and Cole (1971)(3), Dempsey (1971)(4) and Monique Laurendeau-Bendavid (1977). There are others cited by Dasen (1972) like Hendrikz (1966), Prince (1968a), and Pinard et al (1969) who believe that there is a direct relationship between schooling and conservation.

In an attempt to extend the work of Greenfield (1966), Owoc (1973) conducted an investigation on 449 Nigerian subjects selected according to schooling, non-schooling,

- 1- Ibid., p. 226.
- 2- Ibid., pp. 218-219.
- 3- T. Ciborowski and M. Cole, 'Cultural Differences in Learning Conceptual Rules', *International Journal of Psychology*, 6(1), 1971, pp. 25-37.
- 4- D.A. Dempsey, 'Time Conservation Across Cultures', *International Journal of Psychology*, 6(2), 1971, pp. 115-120.

urban and rural areas. Owoc re-emphasized the differences, observed by Greenfield (1969), between schooled and non-schooled subjects, and added that among unschooled groups, the levelling off of cognitive development began to occur as early as ages eight to nine for children living in urban as well as rural settings.(1)

A similar conclusion can be noticed by Rogoff (1981) in her pursuit to find out and explain the relationship between schooling and cognition. She reported that the results of Piagetian tests suggested that schooled children were more liable to attain conservation and that schooling was a necessary factor to solve the problems of formal operations on the ground that non-schooled children seem to prefer to come to conclusions on the basis of experience rather than depending on the information given in the test alone.(2)

Concerned with the question of the universality of Piaget's theory and aiming at determining the influence of the type of culture and the degree of schooling on cognitive development, Laurendeau-Bendavid conducted a cross-cultural research in Rwanda in Central Africa and

- 1- P.J. Owoc, 'On Culture and Conservation Once Again', *International Journal of Psychology*, 1973, 8, 4, pp. 249-254.
- 2- Barbara Rogoff, 'Schooling and the Development of Cognitive Skills', in *Handbook of Cross-cultural Psychology: Developmental Psychology*, ed. H. C. Triandis and A. Heron, 1981, Vol. 4, p. 285.

French Canada in Montreal.(1) She found that cultural and educational variations were influential at certain stages of cognitive development but they did not affect the sequence of the stages.(2) Moreover, there were differences between the partially schooled and unschooled Rwandese, and in all the task employed the Rwandese children attained the stages later than the Montreal children.(3)

Similarly, Schorr (1975) not only stressed the importance of schooling in conservation attainment but drew a distinction between children with an enriched school experience and those with a restricted school experience, where the former attained conservation at a higher level than the latter did. On the other hand children from a middle socioeconomic background attained conservation better than children from a lower socioeconomic background.(4)

Conversely, the influence of schooling on children's operational development is refuted in a study done by

- 1- Monique Laurendeau-Bendavid, 'Culture, Schooling, and cognitive Development: A Comparative Study of Children in French Canada and Rwanda', trans., H. Feider, in *Piagetian Psychology: Cross-cultural Contributions*, ed. P. R. Dasen, Gardner Press, 1977, pp. 128-129.
- 2- Ibid., p. 139.
- 3- Ibid., pp. 143-147.
- 4- N. Schorr, 'A Study of the Relationship Between School Experience, Socioeconomic Status and Conservation Attainment in First Grade Boys and Girls', *Diss. Abstr.*, 1975, 36, 4, p. 2111A.

Kiminyo (1977) among Kamba children in Kenya(1) in which one hundred and twenty subjects were tested, of whom 60 were chosen as urban and schooled and 60 as rural and unschooled. Subjects were divided into groups matching in age, sex and number of years spent in school, and ranged from seven to twelve years of age. Kiminyo used the traditional Piagetian tasks for conservation of mass, weight and volume. He indicated that no significant differences could be noticed between: (a) urban and rural, (b) schooling and nonschooling, and (c) male and female subjects in total scores on the tasks. There were differences between age groups and between types of conservation tasks. To sum up, Kiminyo's results indicated that Kamba children attained conservation sequentially and in accordance with Piaget's theory of cognitive development.(2)

The view put forward by Kiminyo concerning schooling as not an influential factor in conservation tasks is supported by Goodnow and Bethon (1966) in the study carried out in Hong Kong in which they do not observe differences in the American children and the unschooled Chinese subjects in the conservation concepts of

- 1-Daniel M. Kiminyo, 'A Cross-cultural Study of the Development of Conservation of Mass, Weight, and Volume Among Kamba Children', in *Piagetian Psychology: Cross-cultural Contributions*, ed. P.R. Dasen, 1977, pp. 64-88.
- 2- Ibid., p. 87.

substance, weight, volume and area.(1)

Mermelstein and Shulman (1967) were in agreement finding that no differences could be ascribed to the influence of non-schooling on conservation concept.(2) However, they shared Goodnow and Bethon 's conclusion that the difference was observed only within one questioning condition: to the former's subjects the difference was between verbal and non-verbal tasks, while to the latter's the difference was found in the task of combinatorial reasoning.

In line with this point of view, Nyiti (1973), in an unpublished PhD thesis, found no differences between schooled and unschooled subjects tested in Tanzania. To Nyiti, as well as Kiminyo (1973), the ability of the testers in intercultural comparison was an essential factor in determining the results, that is to say, able testers who were not suffering linguistic or cultural handicaps can elicit better performance from unschooled children when compared to their schooled peers.(3)

Maccoby and Modiano (1969) not only support the above-mentioned view but also, like Kiminyo (1977), they suggest that unschooled children are superior to schooled

- 1- J. Goodnow and G. Bethon, 'Piaget's Tasks: The Effect of Schooling and Intelligence', *Child Development*, 1966, 37, pp. 573-582.
- 2- E. Mermelstein and L.S. Shulman, 'Lack of formal Schooling and the Acquisition of Conservation', *Child Development*, 1967, 38, pp. 39-52.
- 3- Mentioned in S. and C. Modgil, *Piagetian Research: Compilation and Commentary*, 1976, Vol. 8, p. 167.

counterparts on the assumption that children in school have little time for the freedom needed for autoregulating experiences which are important to the development of conservation(1) and as a result 'concepts are quickly put into boxes and the uniqueness of experience is lost'.(2)

Similarly, Philp and Kelly (1974)(3) find that in Papua-New Guinea Schooled and unschooled children are identical in behaviour on the Brunerian process-type tasks.(4) Dasen (1972a) cites others who do not believe that there is any direct relationship between the development of concrete operations and Western-type schooling among whom are Goodnow (1962), Waddell (1968), Kelly (1970) and Heron (1971).(5) Moreover, Waddell (1968) in her unpublished paper presented to a seminar, as indicated by Dasen (1972), suggests that schooling affects in New Guinea or Senegal Because it generates the cultural stimulation, while it is not influential in Hong Kong because the cultural stimulation is obtained there without schooling. This is what Dasen calls a partial resolution

- 1- Daniel M. Kiminyo, 'A Cross-cultural Study of the Development of Conservation of Mass, Weight, and Volume Among Kamba Children', p. 68.
- 2- M. Maccoby and N. Modiano, 'Cognitive Style in Rural and Urban Mexico', *Human Development*, 1969, 12, pp. 22-33.
- 3- H. Philp and M. Kelly, 'Product and Process in Cognitive Development: Some Comparative Data on the Performance of School Age Children in Different Cultures', *British Journal of Educational Psychology*, 1974, 44, 3, pp. 248-265.
- 4-For details of Bruner's process type tests see Ibid., pp. 251-253.
- 5- Dasen, 'Cross-cultural Piagetian Research: A Summary', pp. 34.

of the contradiction between the results concerning the importance of schooling as a major factor in cognitive development.

Differences observed among highland children of Papua New Guinea in the Performance in cognitive tasks undertaken by Kelly and Philp (1975) are due to the amount of school experience and the language of testing. Yet, they describe the language of testing as the more significant factor in the tasks than the amount of school experience.(1) It is noteworthy that Dasen cites De Lemos (1969) as one of those who propose this partial resolution.(2)

5.5 EUROPEAN CONTACT AS A FACTOR IN COGNITIVE DEVELOPMENT

In cross-cultural studies, schooling and European contact represent the most prominent influences dealt with on cognitive development. The relationship between schooling and cognitive development, directly or indirectly, is elucidated in the review of the above-mentioned studies (e.g. Greenfield, 1969; Price-Williams, 1962; Owoc, 1973; Rogoff, 1981; Okonji, 1971; Laurendeau, 1977; Kiminyo, 1977; Goddnow and Bethon, 1966,

- 1- M. Kelly and H. Philp, 'Vernacular Test Instructions in Relation to Cognitive Task Behaviour Among Highland Children of Papua New Guinea', *British Journal of Educational Psychology*, 1975, 45, pp. 189-197.
- 2- Dasen, Op.Cit., pp. 34-35.

among others).

Dasen (1972a) puts forward the view that in cognitive development European contact and the stimulation created by schooling seem to be more important than schooling itself(1) whose effects are thought to be 'less systematic' (Dasen and Heron, 1981).(2)

Significant differences in the rate of operational development which are reported by many authors, reviewed by Dasen (1972a), to be on the side of the high-contact groups are seen, Dasen believes, as attributable to the length of contact and to the extent to which traditional values and activities exist. In this respect Dasen (1972a) excludes Greenfield (1966), referred to in the present study as 1969, on the basis that city-schooled Wolof children's performance is lower than bush-schooled children until the age of 11 to 13 years.(3)

Vernon (1967) in a study administered in Uganda makes a comparison between the results of the African subjects and the results he obtains from a series of cross-cultural researches carried out in Britain, in the Hebrides, in Jamaica (Vernon, 1965), and with Canadian Indians and Eskimos (Veron, 1966). To justify the choice of Uganda for undertaking this study of the effects of extreme environmental differences on intellectual and educational

1- Ibid., p. 35.

2- 'Cross-cultural Tests of Piaget's Theory', p. 312.

3- Dasen, Op.cit., p. 35.

development, he explains that Uganda, like Kenya and Tanzania as well as any ex-British territory, adopts an educational system which is to a great extent inherited from the British pattern.(1) He claims that the sample of fifty African boys aged 12 years is considered typical of the whole range of urbanized African despite the fact that tribal and linguistic diversity reduce the possibility of getting a virtually representative sample of boys in any African country, and above all, hardly 30 per cent of this age group even go to school.

The performance of the Ugandans on conceptual development compared to that of the Jamaicans is far lower while it is as poor as that of the Indians. Half of the Ugandan subjects do not attain conservation of every item tested.

Although Vernon attributes this failure to verbal inability, he sees the difference between Ugandans and Jamaicans as stemming from the fact that Jamaicans have had more contact with British and North American cultures besides they have outgrown tribalism and multilingualism. There are, however, some general African factors which may be responsible for that hindrance in conservation tasks such as methods of teaching, child-rearing practices, material conditions, bad health and malnutrition.

1-P.E. Vernon, 'Abilities and Educational Attainments in an East African Environment', in *Cross-cultural Studies*, ed., D.R. Price-Williams, 1969, p. 77.

Vernon's (1966) results indicate that Eskimos' performance of perceptual-spatial operativity is higher than that of West Indians and Canadian Indians. In this respect, the difference may be due to the factor that the Eskimo children train in tracking and locating objects and this contribute to their high performance in perceptual-spatial operativity.(1)

In an attempt to assess the relative performance of various cultural groups including Scottish, Ugandan, Eskimo, Canadian, Indian, Jamaican and English boys of age 11 years, and to identify environmental factors (Dasen 1972a) affecting cognitive development, Vernon (1969) finds that Ugandan economic status and cultural stimulus have significant bearing on the child's performance, whereas in the case of Indian and Eskimo boys specific experiences affect the performance in spatial and perceptual tests (Maccoby and Modiano, 1969; Kiminyo, 1977; Waines, 1984). The results of this study show that 50 per cent of the Ugandans failed conservation on every item which is the same result of Vernon (1967), while 'Hostel' Eskimos fail 40 per cent, 'town' Eskimos 51 per cent, Indians 56 per cent and English 14 per cent.(2)

- 1- Vernon, 'Educational and Intellectual Development Among Canadian Indians and Eskimos', *Educational Review*, 1966, 18, pp. 79-91 and 186-195.
- 2- Vernon, 'Intelligence and Cultural Environment', (Abstract) in S. Modgil *Piagetian Research: A Handbook of Recent Studies*, NFER, Windsor Berks, 1974, p. 233.

A research administered by Price-Williams, Gordon and Ramirez III (1969) shows that children of Mexican "potters" performed better on conservation of substance test than children of "non-potters". Price-Williams et al (1969) suggest that the role of skills in cognitive development may be a very important factor.(1)

The urban-rural dimension as a factor in concept attainment is employed by Greenfield (1969), Owoc (1973) - both are above reviewed - Poole (1968) and Fitzgerald (1970). In her unpublished PhD thesis, Fitzgerald confirms the superiority of the Ghanaian elite children to village children in conservation tasks. Moreover, elite children are superior in performance to the subjects chosen from crowded urban areas.(2) To some extent, this conclusion is compatible with Omari's and MacGinitie's (1974) findings in their study conducted in Tanzania in which they used two versions of Hudson's (1960) pictures. One of the two versions used was revised.(3) The authors concluded that revised-version scores were higher and increase with age, whereas the original-version scores were low in all grades. On the whole, the urban subjects performed at

- 1- D. Price-Williams, W. Gordon and M. Ramirez III, 'Skill and Conservation : A Study of Pottery-Making Children', in *Culture and Cognition: Readings in Cross-Cultural Psychology*, ed. J.W. Berry and P.R. Dasen, 1974, pp. 351-352.
- 2- Cited in S. and C.M. Odgil, *Piagetian Research: Compilation and Commentary*, 1976, Vol.8, p. 167.
- 3- For full details of examples of Hudson's (1960) pictures, see I.M. Omari and W.H. MacGinitie, 'Some Pictorial Artifacts in Studies of Africa Children's Pictorial Depth Perception', *Child Development*, 1974, 45, pp. 536-537.

higher levels than the remote area subjects.(1)

In a cross-cultural study of conservation carried out in Australia, England, Holland, New Zealand, Poland and Uganda in order to estimate the rate of conservation acquisition in several different cultures, Goldschmid et al (1973) reported that the rate of conservation acquisition was found to be comparatively different across the samples studied. The number of the subjects were 1500 classified as 25 boys and 25 girls from each of 5 age groups from 4-8 years in each country. The subjects were tested on the Piagetian tasks of conservation of two-dimensional space, number, substance, quantity and wieght, and discontinuous quantity. The variations which the researchers find among the groups compared are ascribed to specific environmental differences.(2)

A different point of view is held by Hudson (1969) who argues that in Africa homogeneity mainly relies upon the extent of acculturation, of industrialization, of urbanization, of education and ultimately of pictorial experience. This homogeneity could be found in a classroom, but it is neither automatically nor universally noticed because acculturation level of the pupils in a certain classroom in a certain area is basically different from that of those in the same educational standard in

1- Ibid., pp. 535-539.

2- M. L. Goldschmid et al, 'A Cross-cultural Investigation of Conservation', *Journal of Cross-cultural Psychology*, 1973, 4, 1, pp. 49-75.

another area.(1)

In her investigation of the development of conservation concept among Australian Aboriginal children, De Lemos (1969) indicated that conservation of area was achieved later than conservation of quantity and length, and in general the concept of conservation developed later in Aboriginal than in European children. De Lemos ascribed this lag to a lack of activity methods in schools and linguistic factors on one side and to genetic factors on the other. From her results, the important role played by environmental factors in the development of conservation on concepts was presented and affirmed.(2)

Carrying out a series of investigations in Australia, DeLacey (1971a, 1971b and 1974) tried to find out whether efficacy in classificatory tasks and milieu were associated in each of the main ethnic groups in Australia, and to investigate any differences in the level of cognitive functioning between reserve and town - dwelling part - Aborigines. In comparison, the European subjects generally performed better than the Aboriginal peers in the development of operational thinking while a small sample of high-contact Aborigines and the low-socio-economic Europeans performed at the same level

- 1- W. Hudson, 'The study of the Problem of Pictorial Perception Among Unacculturated Groups', in *Cross-cultural studies*, ed. D.R. Price-Williams, 1969, p. 156.
- 2- M. De Lemos, 'The Development of Conservation in Aborigininal Children', *International Journal of Psychology*, 1969, 4, pp. 255-269.

(DeLacey, 1974, conducted in 1970).(1) Because the subjects of the above study were small, DeLacey (1971a) extended his investigation and found that the results confirmed his previous finding that 'full-blood' Aboriginal subjects demonstrated classificatory effectiveness the same level as white subjects in a similar low socio-economic urban environment.(2)

DeLacey (1971b) concluded that the European subjects performed better than the town part-Aboriginals on the Peabody Picture Vocabulary and the Nixon Test (1967) whereas the town part-Aboriginals performed higher than the reserve part-Aboriginals on both tests. Moreover, he suggested that due to the low correlations between scores achieved by rural part-aboriginals on two tests administered and due to their heterogeneity, it was very difficult to consider them a single population in studies of cognitive development.(3)

Dasen (1972b) undertook an investigation in an attempt to replicate the findings of De Lemos (1969) concerning the development of conservation in Australian Aborigines. On the one hand, Dasen supported De Lemos's results

- 1- P. DeLacey, 'Across-cultural Study of Classificatory Ability in Australia', in *Culture and Cognition: Readings in Cross-cultural Psychology*, ed. J. W. Berry and P.R. Dasen, 1974, pp. 353-365.
- 2- P. DeLacey, 'Classificatory Ability and Verbal Intelligence Among High-Contact Aboriginal and Low Socioeconomic White Australian Children', *Journal of Cross-cultural Psychology*, 1971,2,4, pp.393-406.
- 3- P. DeLacey, 'Verbal Intelligence, Operational thinking and Environment in Part-Aboriginal Children', *Australian Journal of Psychology*, 1971, 23, pp. 145-149.

concerning the qualitative and quantitative aspects of operational development which in turn substantiated the classification of the three stages of Piaget. On the other hand, he came full circle to the opposite view that genetic differences, were responsible for De Lemos's result that part-blood Aboriginal children conserved better than full-blood children. With respect to the failure of a large proportion of Dasen's subjects to attain stage three, he attributed this to one or a combination of these reasons:-

- (a) the change in test materials,
- (b) the reduction of an effect of separation of the testing sessions, and
- (c) the elimination of systematic order effects in his study.(1)

On the whole, Dasen argued:

'our results cannot of course, be taken as conclusive until their contradiction with those obtained by de Lemos has been resolved. However, until this can be done, de Lemos's results should no longer be used to support the argument for genetic differences in mental functioning.(2)

Dasen (1974) continued his investigation with three hypotheses each of which was based on the findings of previous studies investigating^a the development of concrete

- 1- P. Dasen, 'The Development of Conservation in Aboriginal Children : A Replication Study', *International Journal of Psychology*, 1972, 7, 2, p. 79.
- 2- Ibid., p.84.

operations in general and in Australian Aborigines in particular. Dasen's three hypotheses were based on the findings of studies cited by in his work (e.g. Dasen, 1972a; De Lemos, 1966, 1969b; Greenfield, 1966 (1969 in this present study); Mohseni, 1966; Poole, 1968; Lloyd, 1971a, 1971b; DeLacey, 1970b; Berry, 1966b, 1971).(1)

The first hypothesis, concerned with the qualitative aspects of operational development as being identical in Australian Aborigines and in Europeans but with a slower rate in the former, was confirmed. Dasen's results supported his second hypothesis that the rate of operational development was faster in the medium-contact group than in the low-contact group. Therefore, he suggested that 'the influence of European contact is more marked where concepts are concerned which are less relevant to the Aboriginal culture'.(2) With regard to the third hypothesis that the Australian Aborigines will develop spatial operations relatively earlier than logic-mathematical merely in virtue of their ecological and cultural background, Dasen observed that the Aboriginal subjects acquired the particular set of spatial operations tested before they acquired the particular set of logic-mathematical operations, while the European subject found the logic-mathematical tests relatively

- 1- P. Dasen, 'The Influence of Ecology, Culture and European Contact on Cognitive Development in Australian Aborigines', in *Culture and Cognition: Readings in Cross-cultural Psychology*, ed. J. Berry and P. Dasen, 1974, pp. 381-408.
- 2- Ibid., p. 403.

easier, and as a result the third hypothesis was confirmed.(1)

In her analytical study of paradoxical and progressive researches on cross-cultural and Piagetian theory, Greenfield (1976) recommended that cognitive development in non-Western countries should be studied by native investigators in order to obtain ideal results. She described this way as a living reality distinct from a mere theoretical abstraction.(2) Moreover, she determined that a second best approach for a foreign social investigator was to ascertain this ideal type through empirical research - interviews and the like.(3)

At the same time Carlson (1976) identified the basic problem of cross-cultural research as the lack of intensive knowledge of the culture under investigation. Therefore he asked for a combination of the efforts of psychologists and anthropologists in order to obtain a genuine understanding of the process of development, and to provide appropriate developmental data distinguished from a comparison of one age sample in a particular culture with the same age sample from another culture.(4)

1- Ibid., p. 406.

2- Patricia M. Greenfield, "Cross-Cultural Research and Piagetian Theory: Paradox and Progress", in *The Developing Individual in a Changing World*, (Vol.I), ed. Friegel and Meacham, p. 325.

3- Ibid.

4- Jerry Carlson, "Cross-Cultural Piagetian Studies: What Can They Tell Us?", in *The Developing Individual in a Changing World*, Vol.I, ed. Friegel and Meacham, pp. 334-345.

Following the same line of thought Furby (1980) found it misleading to make comparison between cultural groups without considering their respective different developmental processes and histories. Furby criticised the obvious tendency of Western investigators to concentrate on the lower performance of non-Western children compared to Western equivalents without learning much about what non-Western children were doing.(1)

- 1- Lita Furby, "Implications of Cross-Cultural Piagetian Research for Cognitive Development Theory", in *Toward a Theory of Psychological Development*, ed. S. and C. Modgil, NFER, 1980, pp. 541-564.

CHAPTER SIX

SCIENCE CONCEPTS : PRACTICAL STUDY (METHODS AND PROCEDURE)

”. . . . intelligence is an inference from behaviour; it can be inferred in a variety of ways, the size of a person’s vocabulary, his ability to solve problems in the abstract or in practical and concrete situations - all these are clearly ‘intelligent’ in varying degrees”.

(A. Clarke, "Intelligence")
* * * * *

6.1 HYPOTHESES

These tests were administered in conjunction with the pilot study on Piagetian animism and as an integral part of the whole investigation into the development of the child's conceptual thinking as regards Piaget's theory of cognitive development. For this purpose, five questions were to be examined:

1. To determine whether Piagetian concrete and formal stages of cognitive development would manifest themselves in the performance of children developing scientific concepts.
2. In the event of the existence of Piagetian stages, the aim was to determine whether clear evidence for specific ages at which children progress from stage to stage would be provided.
3. Even if Piagetian stages should be manifested in the children's performance, this hypothesis was to determine whether cognitive development in Middle-Eastern children (Egyptians) would inevitably follow the same sequential succession of concrete and formal stages and sub-stages described by Piaget in Middle-class Western children (English).
4. To examine whether there would be a substantial relationship between late formal operations and cultural differences. In other words, would the

average age at which children pass through each stage vary from one country to another.

5. To determine whether there would be a significant relationship between the children's attainment of late formal operations and sex.

6.2 SUBJECTS

In order to assess, both culturally and cross-culturally, the performance of children in demonstrating early and later concrete operational thinking, and early and late formal operational thinking, a sample of 502 children was selected from Egyptian and English schools. The children of each country were divided into three age-groups (11, 13, and 15 years).

As regards the Egyptian sample, it was initially intended to be confined to the schools of the city of Aswan. But with the help and permission of the Egyptian Ministry of Education, and of the headmasters of the schools chosen, the selection of children was extended to include children from the schools of the city of Tanta as well. This was positively approved by the researcher on the basis of obtaining representative distributions of Piaget's concrete and formal operational stages in an Egyptian child population as appropriate and wide as possible. In terms of region, Aswan represents the farthest point South of Egypt, or specifically Upper Egypt, while Tanta lies in the far North, Lower Egypt.

Tanta, a city of almost two million(1), is the Capital of Al-Gharbeyah Governate, located in the middle of the Delta (see Map 1). The Egyptian sample (a total of 270 children) was distributed as 142 boys and girls taken from the city of Aswan and 128 boys and girls taken from Tanta, the city as well as its near rural areas. Accurate determination of socioeconomic classes in Egyptian government schools proved as difficult as the determination of socioeconomic classes in the whole of modern Egypt, but roughly speaking, the majority of the children participating in the tests tended to belong to middle socioeconomic status.

For the 11 year old group, children were taken equally from one school in each Town: 45 boys and girls from Ali Naser Primary School in the city of Aswan, 45 boys and girls from Meet Hebaish Primary School in Tanta. Meet Hebaish is a small village near Tanta, but most people there are not farmers although they live there they work in Tanta.

The 15 year old children were also selected equally from one school in each Town: 45 children from Atlas Secondary School [For Boys and Girls] in the city of Aswan and 45 boys and girls from al-Sadat Secondary Comprehensive School in the city of Tanta. Al-Sadat School is one of the only two comprehensive secondary schools recently established in Egypt, as a government

1- Vada Hart, *Modern Egypt*, State Information Service, Egyptian Ministry of Information, 1985, p. 36.

introductoty programme planned to integrate academic and technical education.(1)

As for the age group 13, a total of 52 children were taken from three schools in Aswan: Aswan Preparatory School for Girls (14 children), Abdel-Hamid Abdel-Ghafour Preparatory School for Girls (12 children) and Al-Muwassah School for boys (26 children), all being located in the city of Aswan. In the area of Tanta, the children were taken from one school: 36 children from Deffrah Preparatory School. Deffrah is also a village near Tanta, whose population is identical to that of Meet Hebaish. Table (6.1) shows the distrtribution of the whole Egyptian sample in terms of town, age, and sex.

Table (6.1)
Distribution of the Egyptian Sample

Child Population		Aswan		Tanta		Total	
N.	Mean Age	M	F	M	F	M	F
90	11 years 6 months	25	20	23	22	48	42
90	13 years 7 months	26	26	24	14	50	40
90	15 years 3 months	24	21	26	19	50	40

1- "Education", in *Egypt: Facts and Figures*, State Information Service, Egyptian Ministry of Information, 1985, p. 97.

For the English sample, the tests were carried out in the schools of the city of Durham, County Durham, North East of England. The population of Durham City is 39.8 thousands.(1) A total of 232 English subjects participated in the tests. Children of age 11 were taken from two schools: 60 boys and girls from Blue Coat School, and 30 boys and girls from Durham Finchale County Junior School both in the Newton Hall area. Children of ages 13 and 15 were taken from different school classes in Gilesgate Comprehensive School in the Gilesgate Moor area (84 boys and girls of age 13 and 58 boys and girls of age 15). Table (6.2) shows the distribution of English children in terms of school, age and sex. As shown in table the number of girls was not balanced by the number of boys, especially at age 15:

Table (6.2)
Distribution of the English Sample

Child Population		Blue Coat Sch.		Finch-ale Junior		Giles-gate Comp.		Total	
N.	Mean Age	M	F	M	F	M	F	M	F
90	11 years 7 months	26	34	17	13	-	-	43	47
84	13 years 6 months	-	-	-	-	45	39	45	39
58	15 years 2 months	-	-	-	-	47	11	47	11

1- *County Durham in Figures*, Durham County Council, 1986.

6.3 DESCRIPTION OF TESTS

Three groups of tests, classified in accordance with the three branches of integrated science (biology, chemistry and physics), were carried out on the subjects. The tests were based on an application of Piaget's *The Growth of Logical Thinking* (Inhelder and Piaget, 1958), two tests being drawn from *Assessment of Performance Unit, Science in Schools*, Age 11 (1981), age 13 (1982), and age 15 (1982), and from *Science Report for teachers: 1* age 11 (1983), *Science Report for teachers: 2* age 13 & 15 (1984), and *Science Report for teachers: 3* age 13 (1984). All these reports were published by the Department of Education and Science.

The tests were chosen according to the science curricula studied in both countries. Fortunately there was almost no essential difference in English and Egyptian science curricula as far as teaching science to the three age-groups was concerned. This was clearly evidenced by the science curricula contained in science books for grade six of primary schools, grades one, two, and three of preparatory schools, and grade one of secondary schools, published by Egyptian Ministry of Education and taught in all government schools.

Furthermore, the tests chosen were in line with other Egyptian science tests published in 1978 by the Central

Agency for Educational Books and Aids, which were drawn from American science tests.(1)

It was taken into consideration that the questions selected should not test the child's direct information of pure science, but his ability to apply his knowledge of scientific concepts to presented situations.

6.3.1 Tests of Biological Concepts for Ages 11, and 13

This group included 15 tests. the purpose being to investigate children's performance in the concept of the interdependence of living things, the concept of life cycles, the concept of adaptation of living things, the concept of causality, applying learning, classification and observation. Some concepts were tested with a variety of questions so as to assess more accurately the children's understanding of the concept without limiting them to one particular context. The order of the questions was arranged in terms of predicted difficulty and time in the sense that comparatively easy questions which needed little time came first. This aimed at obtaining the maximum number of answers from the slower children. It also gave the opportunity to have at least one answer to each concept from the pupils who tended to be slow in their performance and to leave later questions unanswered.

1- I.B. Omairah and M.Y. Al-Egaizi, *Tests in General Science* (1978), *Tests in Science* (1978), *Physics Test* (1978), and *Understanding Science Test* (1978).

Question 1: "Life Cycle"

The question tested the concept of the life cycle by presenting pictures of the stages of the life cycle of a frog jumbled up. Each picture was marked with a letter. The children were asked to write the letters in the correct sequence in which the stages occur. The mark scheme was one mark for the correct order of the stages, and no mark for the wrong succession.

Question 2: "Food Chain"

This assessed the concept of the interdependence of living things by presenting five different food chains of which one was incongruent. The pupils were asked to recognize the odd food chain. The correct answer required the child to know that a pansy is a plant and cannot eat, which it was assumed would be everyday knowledge. The mark scheme was one mark for the correct answer, no mark being given for the wrong tick.

Question 3: "Fish Tank"

This question tested the concept of causality as well as observation by presenting a situation in which the fish in a fish tank spent more time near the surface than near the bottom of the tank when the light was on. The pupils were asked to suggest two possible explanations which could account for the situation presented. The mark scheme was two marks for each reasonable and accepted hypothesis.

Question 4: "Field of Grass"

The question was to assess the concept of the adaptation

of living things by presenting four graphs showing the measurement of carbon dioxide in the air over two fields. The two real measurements, which were taken every six hours during one full day, were among the four graphs. The pupils were asked to choose: first, the graph which showed the carbon dioxide concentration in the air over the field of tall grass; second the graph which showed the carbon dioxide concentration in the air over the newly ploughed field. The correct answers required the children to understand which gases are taken in or expelled by plants; as a combined effect of the two processes, respiration and photosynthesis, during the day and night. The mark scheme was one mark for each correct graph.

Question 5: "Beak Shapes"

This question tested the pupils's ability to classify certain living things and to suggest possible explanations for their observations. The objects presented were pictures of five different birds, each of which was marked with a letter. The subjects were asked to choose two of these birds that would eat the same kind of food and then to explain the reason of their choice. The mark scheme was one mark for the correct choice and two marks for reasonable explanations.

Question 6: "Food Web"

This was to assess another aspect of the concept of the interdependence of living things presented in the form of a food web. The children were asked about the effect of

an increase or decrease in the number of rabbits on other animals in the food web. The mark scheme was a maximum of six marks (one for each correct choice).

Question 7: "Ivy"

Like question, 3 this question assessed the concept of causality through observation and the application of science concepts to a different situation. The subjects were asked to give two reasons why the ivy might grow only on one side of the tree and not on the side nearest to a path. The mark scheme was two marks for each reasonable explanation.

Question 8: "Street Lamp"

This concerned the concept of the adaptation of living things and their response to the environment. The situation was about a tree in late October. The tree had no leaves except on the side next to a street lamp. The pupils were asked to choose one of the five given physical and chemical factors of environment that could affect leaf-fall. Then they were asked about their expectation of the appearance of the tree in January, which tested the concept of seasonal cycles. One mark was given to each correct tick in the two parts.

Question 9: "Senses"

This aimed to test the pupils understanding of the concept of the function of senses by applying the general idea that different senses detect different kinds of information about the environment. The situation

presented was a picture of four children each of whom had one of the five senses nonfunctioning. The pupils were asked to detect one of the five things presented the state of which all of the four children would be able to recognize its state, and then to explain the reason for their choice. The mark scheme was one mark for the correct tick and two marks for the explanation.

Question 10: "Grasshoppers"

The question was intended to assess the children's understanding of the concept of biological adaptation of living things to their environment. The subjects were introduced to create three possible hypotheses for the situation that grasshoppers attract their mates by using sound rather than colour which is used by peacocks for the same purpose. The Mark scheme was one mark for each reasonable hypothesis.

Question 11: "Goosegrass"

The concept of the response of plants to their physical and chemical environment was again assessed, but in this question the subjects' understanding of the classification of living things according to the ways of carrying out life processes was involved. Drawings of two goosegrass plants (one tall and thin, and one short and thick) were presented. The subject was instructed that one was found on open waste-land and one growing up through a hedge. The subject was asked to apply each plant to the environment he would expect it to grow in.

Then he was asked to explain his choice. The mark scheme was three marks for part b, and no mark for part a.

Question 12: "Gas Balance"

The processes of respiration and photosynthesis were more complicated in this question than in question 4. The situation presented was a picture of four air-tight containers. The first contained tadpoles in water, the second tadpoles and plant in water, the third plants in water, and the fourth water only. To determine the way both the concepts of the adaptation of living things and the individual processes of respiration and photosynthesis were combined and linked to each other for them, the subjects were asked what would happen in each container after being left in a well lit place for eight hours. The second part of the question asked why the pupils agreed or disagreed with the suggestion that the water in two of the containers would have about the same amounts of oxygen and also about the same amounts of carbon dioxide. The mark scheme was five marks for part a and one mark for part b.

Question 13: "Snow in Fields"

In this question the concept of causality as dependent upon the observation of a particular situation and the application of science concepts was investigated. The situation consisted of a drawing of two fields next to each other, one freshly ploughed and one covered with grass. After a snow storm there was more snow on the grass than on the ploughed field. The subjects were asked

to suggest two different reasons for the comparative abundance of snow on the grass. The mark scheme was two marks for each relevant explanation.

Question 14: "Stream"

The concept of the balancing effect of the processes of respiration and photosynthesis was again tested, but in a more difficult situation than those in questions 4 and 12. The situation presented was a graph showing the change in the amount of oxygen dissolved during one full day in a stream where animals and plants were living. The pupils were asked first to explain why the amount of oxygen in the stream steadily decreased from 6.00 in the evening until 6.00 in the morning, secondly why the amount of oxygen increased after 6.00 in the morning. Mark scheme was 2 marks for each relevant response.

Question 15: "Tree Section"

The question was about applying biological concepts without stating a learned fact. The situation was a picture of a section of a tree with four growth rings. The subjects were asked about the age of the tree a) if it had grown in an English forest or b) if it came from a forest in a tropical country with two rainy and two dry seasons each year. Then the subjects were asked to show how they decided the supposed age of the tree. The mark scheme was one mark for each correct age and four marks for relevant explanations.

6.3.2 Tests of Chemical Concepts for Ages 11 and 13

The group comprised of 10 questions. These were to assess the subjects' understanding of the chemical concepts of the classification and structure of matter and of chemical interactions in various ways of the sub-categories of the two main concepts. The order of the questions followed the same arrangement as that of the previous group of biological concepts for the same reasons illustrated for that group.

Question 1: "Melting Ice"

The pupils' understanding of the general concept that a substance can be classified as a solid, a liquid or a gas was assessed in this question. The situation presented was a chart showing the measurement of water in a beaker when it first came out of the refrigerator in the form of crushed ice. Then it was measured every minute while it was being heated. The chart was divided into three parts and the pupils were asked to suggest which of ice, water, or steam they would see in each of the three parts. The question required also the subjects' understanding of the sequence of the changes of the state of matter for water by heating and cooling. The mark scheme allocated five marks.

Question 2: "Nail"

In this question the concept of chemical reaction was tested, the situation presented being a picture of a bright and shiny nail left for a few days in a jar

half-full of water. The nail in the diagram was divided into three parts: A) above the water, B) at the surface of the water, and C) in the water. The subjects were asked to choose the point at which they would expect the nail to rust most from four suggestions (the three points A, B, C or D indicating would rust evenly all over). Then they had to justify their choice. The mark scheme was one mark for the correct choice, and one mark for the explanation.

Question 3: "Heating Elements"

The pupils' understanding of the classification and structure of matter as regards metals and non-metals was investigated in this question. Seven elements were presented with their equal masses (2.00 g each) before heating as opposed to their changes in mass after heating. From the observations of the common properties of metals and non-metals through their chemical reactions shown in the table, the pupils were asked to suggest what would happen to the mass of Zinc (not included in the seven elements) after heating and to justify their answers. The mark scheme was four marks for correct responses.

Question 4: "Heating Compounds"

This question assessed the subjects' understanding of some of the characteristics of physical and chemical change. The situation given consisted of a table showing the changes of four different compounds in colour and mass on heating and on cooling. Through observation the pupils had to choose the compound which changed colour on heating

and reversed on cooling. The second part was to choose the compound which reacted on heating. Thus the question tested two chemical factors: that some compounds change colour on heating due to loss of water, but that often these changes are easily reversed on cooling, and that a reduction reaction results in loss in mass by losing oxygen. The Mark scheme allocated one mark for each part.

Question 5: "Coal and Oil"

The characteristics of a solid as distinguished from a liquid were investigated in this question. The situation given was that the pupils were informed of the discovery of deposits of coal and oil in Britain and that the process of removing and transporting oil might be easier than that of coal. The pupils had to suggest three different possible explanations dependent upon their understanding of the classification, properties and structure of matter. The mark scheme was two marks for each relevant explanation.

Question 6: "Acid and Alkali"

The concept of the PH of an acid as affected by reaction with metals, alkalis and in aqueous solution was tested in this question. The situation described was that of a pupil who was trying to change the PH of 10 cm³ of nitric acid by adding a substance to it. The pupils were asked to select one of five suggested additions (calcium metal, the same nitric acid, magnesium metal, alkali, pure water) that would not alter the acidity. The mark scheme was one

mark.

Question 7: "Solution"

The question was to test the understanding that some substance dissolve in water and others do not, but that the latter may dissolve in other liquids. The situation described an experiment in which two students put equal amounts of dry sand, soil, grit and salt in four funnels, to determine how much water each one would soak up, A 100 ml of water was poured into each one. This worked all right until they came to the salt. When they poured the water in almost all the salt disappeared. The subjects were asked to suggest why the salt disappeared but the other solids did not. The mark scheme was three marks for a correct response.

Question 8: "Fountain"

This aimed at testing the subjects' ability to generate alternative hypotheses in applying chemical knowledge. A picture of a marble fountain was presented and the pupils well instructed that it was built in a city centre but after several years the surface of the marble was found worn and covered with small holes. The pupils had to suggest three different hypotheses, other than damage by the people, which could have caused the small holes to form. The mark scheme was one mark for each relevant explanation.

Question 9: "Phosphorus"

This question involved the concept of the conservation of

mass as observed in the general properties of chemical reaction. The situation was presented in a diagram showing a piece of phosphorus held in a flask as shown in the diagram. The mass of the flask and contents equalled 205g. The sun's rays were focused on the phosphorus, which then caught fire. The white smoke produced slowly dissolved in the water. After cooling, the flask and its contents were weighed again. The subjects had to select one of four suggestions (more than 205 g, 205 g, less than 205 g, not enough information to answer) while they would expect the weight to be. Then they had to justify their choice, which, if correct, involved also the concept that the total mass of the reacting substances in any chemical reaction is the same as the total mass of the products, and that matter cannot be created or destroyed. The mark scheme was one mark for the part a and two marks for acceptable and reasonable justifications.

Question 10: "Reactivity"

The concept of the reactivity of some common metals was assessed in this question. The pupils were offered a diagram showing the order of the reactivity of four common metals from the least to the most reactive (zinc, iron, lead, copper). They were instructed that a pupil was asked to heat small quantities of three mixtures: a) iron powder and copper oxide, b) iron powder and lead oxide, and c) iron powder and zinc oxide. The subjects had to apply their chemical concepts to suggest what would happen in each experiment. The mark scheme allocated five marks

for a correct response.

6.3.3 Tests of Physical Concepts for Ages 11 and 13

This group consisted of 12 questions. The aim of these questions was the assessment of the subjects' understanding of the main physical concepts of force and field and the transfer of energy with their sub-categories. The order of the questions did not differ from that adopted in the previous two groups with regard to the comparative difficulty of the questions. This was applied for the same reasons elaborated before.

Question 1: "Freezing"

The concept investigated in this question was related to the general concept of the properties of matter with a specific application of the children's understanding of the effect of the freezing of water and its accompanying volume increase. The pupils were instructed both by words and diagram that it was advisable to leave a gap at the top of the container in the case of freezing soups, sauces or stews. Then the situations presented was a picture of five different containers which could all hold the same amount of liquid. The subjects were asked to select one container which could be filled closest to the top and then to justify their choice. The mark scheme was one for the correct choice, and two for the accepted explanation.

Question 2: "See-Saw"

This question tested the pupils' understanding and

application of the concept that the turning effect of a force about a point is larger when the line of action of the force is further from the point. The situation given consisted of two pictures of a see-saw. One showed the see-saw balanced when a mother was sitting at one end and her two twins at the other. The second picture demonstrated that when one of the twins got off the mother had to alter her position to balance the twin who was left behind. The subjects were asked to select one of four suggested positions for the mother to sit at in order to balance her child. The mark scheme was one mark for the correct choice.

Question 3: "Watering Can"

The understanding of the concept that water tends to flow until the surface reaches a common level was the aim of this question. A watering can was presented in two different positions. In this first position the can was levelled with a horizontal dotted line showing where the surface of the water was in its body. The pupils were asked to draw a line to show where the surface was in the spout. The second position showed the watering can tipped so that the water just began to drip through the spout. The pupils had to draw a line to show where the water surface was in both body and spout. The mark scheme was one mark for the first part, and two marks for the second.

Question 4: "Torch"

In this question the pupils' understanding of the current

electricity concept that a complete circuit conducting material is needed for a steady current to flow between the terminals of a battery, was assessed. It also involved their understanding that some materials conduct electricity better than others, and some are non-conductors or insulators. A diagram of a torch was presented and the pupils were instructed that the torch was not working because the spring at its bottom was covered in rust. But after cleaning it down to the shiny metal, the torch worked. The subjects had to give reasons why cleaning the spring made the torch work. The mark scheme was three marks for a correct explanation.

Question 5: "Car Tyre"

The properties of matter in this question involved the concept of pressure. The pupils were given five ideas related to the properties of particles. They had to explain through these ideas why the pressure in a car tyre increased during a journey. This involved the concepts that particles of matter are in constant motion and that most substances expand as their temperature rises. The mark scheme was three marks for an accurate explanation.

Question 6: "Snails"

The concept that the average speed of an object is obtained by dividing the distance moved by the time taken, was applied in this question. The situation described two students who put four snails down next to each other and marked their trails. The two students put a cross (X)

where each snail had reached after 30 seconds. This was shown in a diagram according to which the pupils were asked simply which snail went fast. The second part of the question involved the calculation of the distance which one of the snail would travel if it went on at the same speed for another 15 seconds. The mark scheme was one mark for the first part and two marks for the second part.

Question 7: "Kettle and Bath"

The physical concept of work and energy was tested in this question. The pupils had to compare the cost of heating a kettle of water to boiling point and a bath of water to just above body temperature. The pupils had to consider the energy expended (costs) in electricity in the light of their understanding of the relation of the volume of water and the temperature rise. The mark scheme was four marks for the justifications and none for the choice.

Question 8: "Electro-magnet"

This question was set to test the physical concept that an electric current in a coil of wire produces a magnetic field round it. The question described a situation in which a girl-pupil had made an electromagnet by winding a piece of wire round something tall and thin. She connected the ends of the wire to a battery, and showed her younger brother how it would pick up a lot of paper clips from a pile on the table. Her brother went away and tried to make one like his sister's for himself. His

electromagnet did not work nearly as well as his sister's. The pupils were asked to apply their knowledge of the general concept of magnetic field to find three reasons why the brother's electromagnet worked less well. The mark scheme was two marks for each relevant suggestion.

Question 9: "Man"

In this question the pupils had to understand the concept that to make an object move there has to be a force acting on it. The situation presented showed a man weighing 700 N on a building site. He was lifting a bucket of cement weighing 200 N. The pupils were asked to select one of five suggested forces (100, 200, 300, 500, 700 N) which they would expect the force of the man's feet on the ground to equal. The mark scheme was one mark.

Question 10: "Salty Water"

In this question the pupils had to use their knowledge of the concept of a current with the increasing degree of the concentration of the solution. This was tested through instructing the subjects that a pupil set up a circuit, the ammeter of which was 0.2 amps. He added an extra tablespoon of salt to the salty water, and stirred it without disturbing the carbon rods. The situation was illustrated in a diagram. The pupils were asked first to select one of four suggestions they would expect to happen to the ammeter reading, and second to justify their choice. The mark scheme was one mark for the first part and two marks for relevant explanations.

Question 11: "Sources of Energy"

The pupils had to apply their knowledge of the concept that there are various sources of energy one of which is a wound spring. A diagram showing the position of a truck in four instances (before winding up; after winding up, moving along, and stopping) was presented. The pupils were asked to select one of five suggested positions at which they would expect the truck to have the most energy. In addition to the four positions, the fifth suggestion was 'same all the time'. The pupils had to justify their choice. The mark scheme was one mark for each part.

Question 12: "Boiling Potatoes"

This question involved the ideas that the time of cooking depends on the temperature of water and that extra heat energy will not change the temperature of water once it is boiling. The situation presented described a cook putting two saucepans on a stove to boil. When they were both boiling she turned the gas under one down low so that the water was just kept boiling. She left the other on high. She thought the one on high would cook the potatoes faster. A friend said it would make no difference to the cooking time of the potatoes. The subjects were asked to predict which of the two persons was right and to justify their choice. The mark scheme was three marks for the justification.

6.3.4 Tests of Biological Concepts for Age 15

This group consisted of ten questions. Three of the questions were used in the group of biological concepts for 11 and 13 years. The general topics of biology such as the interdependence and adaptation of living things, inheritance, and reproduction (sexual and asexual) were assessed in various ways in this group. The order of the questions followed the same arrangement carried out in 11 and 13 years for the same reasons indicated before.

Question 1: "Cyclops"

The question was drawn from the category 'the interdependence of living things'. A food web, more complicated than that used in 11 and 13 years, was presented. The pupils had to predict how a sudden change in one part of the web (cyclops in a canal) would effect another part (daphnia). In part b of the question the subjects were asked to justify their prediction. The mark scheme was one mark for the prediction and two marks for the explanations.

Question 2: "Grasshoppers"

This question was used in 11 and 13 years as question No.10 for the assessment of the adaptation of living things to their environment.

Question 3: "Onion Plant"

The idea of natural variation was tested in this question. The situation presented was a gardener who got all his seeds from one onion plant. He planted half the seeds in

the garden and the other half in a greenhouse making certain that the seeds in the greenhouse were all treated in exactly the same way. The pupils were asked to explain why after 12 months the seeds in the greenhouse produced different sized onions as shown in a table presented. In part b the pupils were asked to explain the reason why the onions in the garden varied more than the onions in the greenhouse as also shown in the table. The mark scheme was two marks for part a, and one mark for part b.

Question 4: "Gas Balance"

This quesstion was used in the 11 and 13 years surveys as question number 12 in order to test the concepts of the adaptation of living things and the individual processes of respiration and photosynthesis.

Question 5: "Mice"

The general concept of inheritance was assessed in this question. In order to investigate the pupils' understanding of the distinction between inherited and non-inherited characteristics, an experiment on inheritance was introduced to them. In the experiment a scientist found a baby mouse born with no tail. When it was adult he mated it with a normal mouse and got some tailless babies. The scientist cut off the tails of some normal adult mice and bred them. When these mated, however, all these baby mice had tails. From this experiment the pupils had to predict what kind of baby mice could be produced from the mating of two mice with chopped-off tails and to explain their prediction. In

part b they had to explain why a mouse born with no tail produced some baby mice with no tails. The mark scheme was two marks for part a and one mark for part b.

Question 6: "Spider Plant"

This question related to the differences in variation produced by sexual as opposed to asexual reproduction. The pupils were instructed that a spider plant was able to reproduce in two ways: by flowers and seeds, and by producing runners. Young plants formed by both methods were raised under identical conditions and the weights of each group after 100 days were shown in a table. The pupils had to select one of five statements which most fully explained the greater range of weights of plants produced from flowers and seeds than those produced from runners. The mark scheme was one mark.

Question 7: "Ivy"

This was used in the 11 and 13 years surveys as question number 7 in order to assess the concept of the adaptation of living things to their environment.

Question 8: "Menstrual Cycle"

This question assessed the pupils' knowledge of the human menstrual cycle. The situation described a girl with regular menstrual cycles who started to menstruate on the 1st of March. She stopped menstruating on the 6th of March. Her next menstruation began on 29th of March. The pupils had to select one of five suggested dates on which they would think it was most likely that she released an

egg from one of her ovaries. The mark scheme was one mark.

Question 9: "Animal Eggs"

Interdependence of living things with the involvement of the idea that predation tends to maintain the balance of populations was assessed in this question. The pupils were introduced to a table showing the number of offsprings that a pair of animals (fish, amphibian, reptile, bird, mammal) produce in one breeding season. The table also showed how offsprings were produced and the amount of parental care. The pupils had to use the information in the table to give two reasons why a fish laid many more eggs than a reptile. The mark scheme was five marks.

Question 10: "Sexual Reproduction"

The distinction between sexual and asexual reproduction was the aim of this question. The pupils were asked to select from a list of four cases of the two methods of reproductions those instances where sexual reproduction had taken place. The mark scheme was four marks.

6.3.5 Tests of Chemical Concepts for Age 15

This group consisted of six questions, two of which were used in the surveys of 11 and 13 years. The questions involved four main topics of chemistry: solutions, reactivity, properties of a chemical reaction, and the classification and structure of matter. The

criteria according to which the order of the questions was arranged did not change from that adopted throughout the tests.

Question 1: "Reaction Rate"

The properties of chemical reactions in this question related to the change in the rate of reaction with temperature. The pupils were instructed that when an excess of solid was added to a solution at 25 C, a gas was given off. The volume of gas measured against time was shown to the pupils in a graph. The pupils had to apply their understanding of the chemical concept that the rate of the reaction changes, but not the volume of the product. They had to select one of the four graphs given which they would expect to show the result if the same experiment was repeated with the solution at 35 C. The mark scheme was one mark for the correct choice.

Question 2: "Sodium"

In this question the general topic of the classification of the structure of matter was involved. Information of an atomic model was given with a table showing the number of protons and electrons in three different atoms (neon, sodium, and magnesium). The pupils had to use this information to select from five suggested predictions the atomic species which would be produced when an electron was removed from a sodium atom. The mark scheme was one mark.

Question 3: "Phosphorus"

For the assessment of the pupils' understanding of the

conservation of mass during a chemical reaction, the same question 'Phosphorus' used in the 11 and 13 years surveys was presented as question number 9.

Question 4: "Nail"

This question was also used in the 11 and 13 years surveys as question number 2 in order to assess the concept that air and water were necessary for rusting to take place.

Question 5: "PH Graph"

The topic of the classification of the structure of matter in this question was concerned with acids and bases. The situation was an experiment in which the PH of a liquid Q was measured. The experimenter added 1 cm³ of a liquid P at intervals and after each addition the PH of Q was measured. A graph of the results was introduced to the pupils. Through the graph the pupils had to classify the two liquids. The question required the pupils to understand that the liquid Q was neutral initially and that it became more acidic when the liquid P was added. The mark scheme was one mark for the correct choice of the five options.

Question 6: "Copper Pipes"

In this question the properties of chemical reactions were again tested in a different way, involving the reaction of copper and oxygen from the air. The situation described a house with hot and cold water pipes in its kitchen. The pupils were asked to give the cause of the pipes being tarnished after originally being shiny. They had also to

explain why the hot water pipe was more tarnished than the cold water pipe. In the third part of the question the pupils were asked to state the substance of which the tarnish was made of. The mark scheme was one mark for each correct answer.

6.3.6 Tests of Physical Concepts for Age 15

This group was made up of nine questions, four of which were conducted in the tests for ages 11 and 13. The aim of the questions was the assessment of the pupils' understanding of various concepts related to three main physical topics: the properties of matter, work and energy, and current electricity. There was no change from other test groups as regards the order of the questions.

Question 1: "Watering Can"

This question was conducted in the physical tests for ages 11 and 13 as question number 3 in order to assess the concept that water tends to flow until the surface reaches a common level.

Question 2: "Energy Transfer"

In this question the pupils had to select instances in which energy was being transferred and when it was not. A list of five jobs was presented. Some of these jobs required the transfer of energy and some did not. Instances where it was not, the mark scheme was five marks.

Question 3: "Kettle and Bath"

This question was used in the 11 and 13 years surveys as question number 7. It also involved the general topic 'work and energy' considered by the children's understanding of the relation between the volume of water and the rise in temperature.

Question 4: "Tables"

This question involved the idea of pressure as related to the general topic 'properties of matter'. A picture of two tables was presented. Table A weighed 40 N and had one base whose area was 400 cm². Table B weighed 80 N and had 4 feet the area of each foot being 100 cm². The pupils had to appreciate that both the weight of the tables and the area in contact with the carpet needed to be considered in order to choose one of the tables which would make the deepest impression on the same carpet. Then they had to justify their choice. The mark scheme was four marks for the justification.

Question 5: "Car Tyre"

This was used in the ages 11 and 13 tests as question number 5 for the assessment of the concept of pressure related to the Kinetic theory of gases.

Question 6: "Drop Sand"

The idea of gravitational potential energy was involved in this question. The solution of the question required the subjects understanding that the Kinetic energy which a falling object could gain depended on the product of its

mass and the height from which it was dropped. Five metal balls of equal size but different masses were dropped on to a tray of damp sand from different heights shown in a diagram. Two questions were asked. In question a) the pupils had to predict the ball that would make the deepest dent, in b) they had to choose the ball that would make the shallowest dent. The mark scheme was one for each correct choice.

Question 7: "Man"

This was used in the tests of the ages 11 and 13 years as question number 9. It concerned the assessment of the concept that to make an object move there has to be a force acting on it.

Question 8: "Current Electricity"

It involved the general topic of current electricity. The pupils had to apply their physical knowledge of reversible relation between resistance and current in two situations. In part a) they had to predict the reading of the ammeter when a 100 cm length of wire was used instead of a 50 cm length and to justify their prediction. In part b) they had also to predict the reading of the ammeter when two 50 cm lengths of the same wire were used side by side instead of the single length and to justify their prediction. The mark scheme was four marks for each part.

Question 9: "Plank"

This question required the subjects to understand that the amount of energy needed to raise an object from one level

to a higher level does not depend on the route taken. Three pictures showing a man raising a heavy roller from one level to another using a rope to pull it up different planks were presented. The pupils had to choose one of four statements concerning the amount of energy he used in each case and to justify their choice. The mark scheme was one mark for the correct choice and two marks for the explanation.

6.4 PROCEDURE

6.4.1 Translation of the Tests

The tests were first translated from English into Arabic by a specialist in both languages. In their Arabic formulation, they were later revised and re-formulated in the scientific terms used in Egyptian science books. This was done by the researcher, as a former student of science, in conjunction with two Egyptian science head-teachers. A full list of the translated tests is included in the appendices.

6.4.2 Date, Timing and Instructions

For the Egyptian sample, the tests were carried out in March and April 1985. The time was difficult for Egyptian pupils because they were preparing themselves for the examinations that would be held in May. Most of the pupils at the time did not attend their schools,

preferring to study at home. Even teachers were busy with final revision. Hence, without the kind co-operation of the head-masters who painstakingly managed to bring their pupils back to schools, it would have been nearly impossible for the researcher to carry out the tests at that particular time.

As regards the English sample, the testing time was no less difficult than that regarding the Egyptian sample. The tests were carried out in the schools of Durham in June and the first half of July 1985, immediately after the researcher's return from Egypt. English pupils were at the end of their academic year. Fortunately, however, the English head-masters were no less kind and helpful than the Egyptians in helping the investigator to overcome this difficulty.

Whether in Egypt or England, the tests were administered by the researcher herself and the teacher of the class whose pupils were tested. The children were examined in successive groups, one at a time. The test package for 15 year olds (25 questions in the three branches of science) was designed to take 70 minutes. The first test package for 11 and 13 year olds (15 biological questions) was designed to take 45 minutes, and the second test package (22 chemical and physical questions) was designed to take 60 minutes. The time was designed according to the timing calculation elucidated

in *Assessment of performance Unit* (1), and under the personal kind advice of one of its authors, Dr. Richard Gott.

Instructions for the tests were first told orally to the subjects before giving them the tests. At the same time these instructions were written on the first page of the test package. They were drawn from the very same instructions used in *Assessment of Performance Unit* .(2)

6.4.3 Criteria for Classification

The classification of the questions into Piagetian levels was based on the behavioural descriptions expounded in *The Growth of Logical Thinking* (Inhelder and Piaget, 1958), and on Michael Shayer's studies (1972a, 1972b, and 1978) in which he made a conversion of these behavioural descriptions into a taxonomy relating to the conceptual demands of *Nuffield Science Courses*. The classifications were also based on the long list of the characteristics corresponding to each developmental stage defined by the authors of *With Objectives in Mind*, 1972. There were 92 characteristics for early concrete, 94 for late concrete, and 96 for the stage of abstract thinking.(3) Table (6.3) shows the characteristics that correspond to each developmental stage.

- 1- DES, *Assessment of Performance Unit, Science in Schools: Age 15*, Report No.1. 1982, p. 3.
- 2- *Ibid.*, pp. 212,3. See also appendices.
- 3- Len Ennever et al, *With Objectives in Mind: Guide to Science 5/13*, Macdonald Educational, London, 1972, pp.60-65.

Table (6.3)
Developmental Stages and Their Characteristics

Stage	Characteristics
(1) Intuitive	This stage is characterised by the child's inability to think about, or even imagine, the consequences of an action unless he actually carries it out. The child is not yet likely to draw logical conclusions from his experiences.
(2A) Early Concrete Operations	The child is developing the ability to solve problems mentally. At first this ability is limited to materials that can be manipulated concretely, and even in this case the ability is developing in a restricted way.
(2B) Established Late Concrete Operations	The child's mental manipulations are becoming more powerfully established. The child is developing his ability to solve varied mental problems in more ordered and quantitative ways than was previously possible.

(3A) Early Formal Operations	The child's ability to think about abstractions is being developed in this stage.
(3B) Established Late Formal Operations	The child's ability to think about, handle, and solve the abstract and hypothetical problems is being fully established at this stage.

For the whole sample of the three age-groups, the questions were administered to cover the four Piagetian stages of developmental thinking: early concrete (2A), late concrete (2B), early formal (3A), and late formal (3B). The classification of the questions into these Piagetian stages was made in the light and guidance of the following studies: Inhelder and Piaget (1958), *Assessment of Performance Unit, With Objectives in Mind* (Len Ennever et al, 1972), *The Conditions of Learning* (Robert M. Gagne, 1970)(1), *Towards a Science of Science Teaching* (Michael Shayer and Philip Adey, 1981)(2), "Conceptual Demands in the Nuffield "O" Level Physics" (M. Shayer, 1972a)(3), "Some Aspects of the Strength and

- 1- Robert M. Gagne, *The Conditions of Learning*, (Second Ed.), 1970.
- 2- Shayer and Adey, *Towards a Science of Science Teaching: Cognitive Development and Curriculum Demand*, Heinemann Educational Books, 1981.
- 3- M. Shayer, "Conceptual Demands in Nuffield "O" Level Physics", in *Cognitive Development in the School Years*, ed. A. Floyd, The Open University, Croom Helm, London, 1979, pp. 340-50.

Limitations of the Application of Piaget's Developmental Psychology to the Planning of Secondary School Science Courses" (M. Shayer, M.ed, 1972b), and finally M. Shayer (1978).(1)

6.4.4 Piagetian Levels for Classifying the Tests

The children of the two age groups 11 and 13 were tested by the same questions. The test consisted of 37 questions on the various concepts of the three science branches (15 biology, 10 chemistry, and 12 physics), including the nine questions repeated in the 15 years survey for the purpose of comparison and investigating the correlation of stages and age. The questions were classified in terms of stages and substages as 6 2A, 14 2B, 11 3A, and 6 3B. To avoid any sort of confusion in the reader's mind, it was thought appropriate to refer to the question by name. For the assessment of level 2A, these six questions were selected: Life Cycle, Food Chain, Snow in Fields, Heating Compounds, Acid and Alkali, and See-Saw. For the assessment of level 2B, these fourteen questions were classified: Field of Grass, Beak Shapes, Street Lamp, Senses, Grasshopper, Goosegrass, Nail, Solution, Fountain, Torch, Snail, Man, Salty Water, and Boiling Potatoes. For the assessment of level 3A, these eleven questions were categorized: Fish Tank, Icy, Melting Ice, Heating elements, Coal and Oil, Reactivity, Freezing,

1- M. Shayer, "The Analysis of Science Curricula for Piagetian Level of Demand", *Studies in Science Education*, (5), 1978, pp. 115-30.

Watering Can, Car Tyre, Electro-magnet, and Sources of Energy. While for the assessment of level 3B, these six questions were selected. Food Web, Gas Balance, Stream, Tree Section, Phosphorus, and Kettle and Bath.

For the 15 year old children the test consisted of twenty five questions for the assessment of the concepts of the three science branches (10 biology, 6 chemistry, and 9 physics), including the nine questions repeated in the tests for 11 and 13 year-olds. The questions were classified as five 2B, ten 3A and ten 3B. For the assessment of level 2B, these five questions were categorized: Grasshoppers, Nail, PH Graph, Copper Pipes, and Man. For the assessment of level 3A, these ten questions were classified: Onion Plant, Spider Plant, Ivy, Menstrual Cycle, Sexual Reproduction, Reaction Rate, Watering Can, Energy Transfer, Tables, and Car Tyre. For the assessment of level 3B, these ten questions were selected: Cyclops, Gas Balance, Mice, Animal Eggs, Sodium, Phosphorus, Kettle and Bath, Drop Sand, Current Electricity, and Plank.

The nine questions that were joint to the tests of all age-groups were classified as follows: three questions investigating level 2B (Grasshopper, Nail, and Man), three questions investigating level 3A (Ivy, Watering Can, and Car Tyre), and three questions investigating level 3B (Gas Balance, Phosphorus, and Kettle and Bath).

The pupil was considered within a particular stage of development if he/she answered correctly two thirds of the question classified for this stage. For some items 50% facility was permitted. As regards the items that were not permitted the 50% facility, scores from 66% to 50% were considered within the sub-stage of the stage tested. The pupils who obtained less than 50% of the marks allotted for a question were considered out of the tested stage and its sub-stage.

6.4.5 Analysis Technique

The data obtained were analysed through the use of SPSS-X programme (Statistical Package for Social Science) available at the Computer Centre, the University of Durham. Frequency, Mean, Standard Deviation (S.D.), Standard Error (S.E), and Mann-Whitney U Test (Siegel, 1956)(1) were employed as the statistical techniques in processing the data obtained. For statistical analysis of the data, the 0.05 level was accepted as an indication of statistical significance.

6.4.6 Validity of the Test

According to *APU, Science in Schools*, the validity of the questions has been judged by a group of science

- 1- Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences*, International Student Edition, McGraw- Hill Kogakusha Ltd., 1956, pp. 116-27.

educators. Seven people working independently scrutinised the questions, and any particular question was considered validated if five of the "validators" assigned it to the same category.(1) Accordingly, the questions used in this study, being taken from the surveys validated in all reports of *APU*, have been considered valid for the assessment of the concepts tested.

(1) *APU, Science in Schools, Age 15: Report No. 1.*,
p. 206.

CHAPTER SEVEN

RESULTS AND DISCUSSION

If the data are interpreted with the theoretical perspectives of David Ausubel we see that they support his contention that problem solving or other cognitive processes are a function of the degree of *relevant* cognitive adequacy'.

(Lawson and Renner, 1974)

* * * * *

RESPONSES OF 11 AND 13-YEAR-OLD CHILDREN

7.1.1 Biological Concepts

The results of the two questions 'Life Cycle' and 'Food Chain' revealed that a very consistent pattern of response was maintained by the 11-year-old Egyptian children (68.9 per cent and 66.7 per cent respectively gave correct answers). English children of the same age performed inconsistently, though higher than the Egyptians. The 93.3 per cent scoring in the question 'Life Cycle' was reduced to 75.6 per cent. The no answer rate was 4.4 per cent of the Egyptians and 1.1 per cent for the English in both questions.

At age 13, the results indicated another inconsistency of English subjects where they had a maximum score in 'Life Cycle', they scored only 69.0 per cent in 'Food Chain', which is lower than the score of their county fellows of age 11 concerning the same question. Egyptian children of age 13 achieved 83.3 per cent in 'Life Cycle' which was reduced to 72.2 per cent in 'Food Chain', but their scores in both questions were higher than that of 11-year-old Egyptian children. The no response rate was 1.1 per cent of the Egyptians and none of the English in 'Life Cycle', and none of the Egyptians and 3.6 per cent of the English in 'Food Chain'. At age 11, the mean score for the Egyptians was 0.69 with S.D. 0.47 and S.E. 0.05, for the English 0.93 with S.D. 0.25 and S.E. 0.03 in 'Life Cycle', while in 'Food Chain' it was 0.67 with S.D. 0.47

and S.E. 0.05 for the Egyptians, and 0.76 with S.D. 0.43 and S.E. 0.05 for the English. At age 13 the mean score was 0.83 with S.D. 0.38 and S.E. 0.04 for the Egyptians, and 1.00 with S.D. 0.00 and S.E. 0.00 for the English in 'Life Cycle', while in 'Food Chain' it was 0.72 with S.D. 0.45 and S.E. 0.05 for the Egyptians and 0.69 with S.D. 0.47 and S.E. 0.05 for the English.

Table 7.1 illustrates the results obtained concerning four biological questions allotted four marks each. It is clear from the table that there were very slight variations among the results of the four questions except for the scoring of English children of both ages in the question 'Stream'. In 'Fish Tank' and 'Ivy' there was little superior performance of English children of both ages over the Egyptians in terms of mean score. In contrast, the superiority of performance turned slightly in favour of the Egyptians in 'Snow in Fields', and was largely displayed in 'Stream'. More specifically at age 11 about half of the Egyptians and two thirds of the English gave one acceptable hypothesis with varying degrees of relating it to the observations in either part of 'Fish Tank'. About 20.0 per cent of the Egyptians and a quarter of the English provided two hypotheses based on the presented observations with the same variations of the degrees of accuracy. The same pattern of attempts was nearly repeated in the question 'Ivy'. In the question 'Snow in Fields' just over 70.0 per cent of the Egyptians and less than 60.0 per cent of the English gave one reason

Table (7.1)

Responses of the Children of Ages 11 and 13 to Four Biological
Questions Allotted 4 Marks Each in Number and Percentage

Ques- tions	Age	Sub. Loc.	Scores												\bar{X}	S.D	S.E
			0		1		2		3		4		P				
			N.	%	N.	%	N.	%	N.	%	N.	%	N.	%			
Fish Tank	11	Eg	22	24.4	14	15.6	21	23.3	10	11.1	3	3.3	20	22.2	1.09	1.21	0.13
		En	29	32.2	17	18.9	24	26.7	16	17.8	4	4.4	-	-	1.43	1.24	0.13
	13	Eg	9	10.0	31	34.4	25	27.8	11	12.2	-	-	14	15.6	1.27	0.98	0.10
		En	11	13.1	15	17.9	30	35.7	19	22.6	7	8.3	2	2.4	1.91	1.17	0.13
Ivy	11	Eg	11	12.2	30	33.3	15	16.7	12	13.3	4	4.4	18	20.0	1.24	1.17	0.12
		En	25	27.8	19	21.1	27	30.0	5	5.6	13	14.4	1	1.1	1.56	1.35	0.14
	13	Eg	4	4.4	14	15.6	26	28.9	15	16.7	9	10.0	22	24.4	1.63	1.33	0.14
		En	8	9.5	11	13.1	36	42.9	18	21.4	11	13.1	-	-	2.16	1.11	0.12
Snow in Fields	11	Eg	13	14.4	18	20.0	33	36.7	12	13.3	1	1.1	13	14.4	1.38	1.08	0.11
		En	37	41.1	24	26.7	21	23.3	5	5.6	2	2.2	1	1.1	0.99	1.04	0.11
	13	Eg	7	7.8	15	16.7	32	35.6	13	14.4	11	12.2	12	13.3	1.80	1.27	0.13
		En	23	27.4	14	16.7	31	36.9	6	7.1	8	9.5	2	2.4	1.50	1.26	0.14
Stream	11	Eg	27	30.0	17	18.9	17	18.9	13	14.4	3	3.3	13	14.4	1.13	1.23	0.13
		En	74	82.2	-	-	1	1.1	-	-	-	-	15	16.7	0.02	0.21	0.02
	13	Eg	38	42.2	9	10.0	8	8.9	14	15.6	8	8.9	13	14.4	1.10	1.45	0.15
		En	56	66.7	8	9.5	5	6.0	-	-	3	3.6	12	14.3	0.36	0.89	0.10

in either part of the question and about half of the Egyptians and a quarter of the English attempted the two parts with different degrees of successful hypotheses. Over half the Egyptians and none of the English took into account either respiration or photosynthesis in one part of the question 'Stream'. About a quarter of the Egyptians and only one English girl considered the balancing effect of both processes in part a and/or b (some referred correctly to the two gasses without mentioning the terms of the two processes).

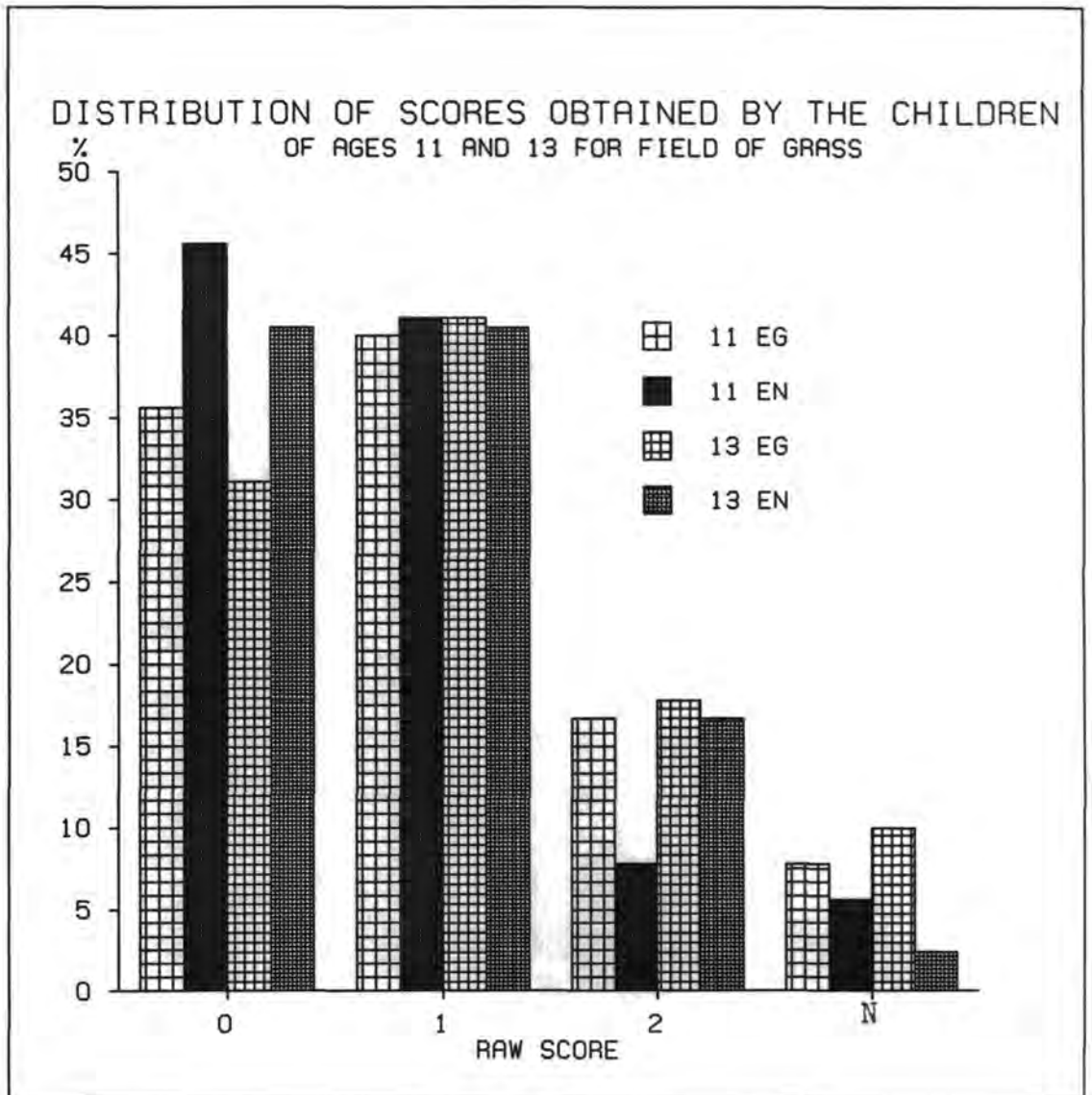
Compared with their country fellows of age 11 of whom 3.3 per cent achieved maximum score in 'Fish Tank', none of the Egyptians of 13 managed to obtain maximum score in this question, yet, the latter's pattern of response was approximately similar to that of the former. The English children of age 13 demonstrated the highest performance in regard to this question, where nearly a third of them gave only one successful reason in either part of the question. About half of them attempted both parts with differences in relevant explanations. The same can be said about their performance on 'Ivy' which was the best among the four questions. The Egyptian 13-year-olds demonstrated a little higher performance on this question than on 'Fish Tank', though their rate of no response was the highest among the four questions. In 'Snow in Fields' the Egyptians maintained a similar pattern of response, whereas the English were less successful, and showed a higher rate of irrelevant explanations. Though nearly

half of the English attempted both parts of the question, and a further half attempted only one part, most of their hypotheses were either inconsistent with the presented situation, or negative types of their first affirmative ones (e.g. flat, not flat; has ridges, has no ridges, etc.).

The performance of the Egyptians on 'Stream' was slightly less successful than the Egyptians of age 11, but largely higher than that of the English of age 13. Only two English subjects as against nineteen Egyptian subjects mentioned the two terms of respiration and photosynthesis, while 7.0 per cent of the former and 13.0 per cent of the latter explained successfully and related correctly the two process without mentioning the two terms in part a and/or part b. The rate of irrelevant answers of both English and Egyptian children of age 13 was the highest among the four questions.

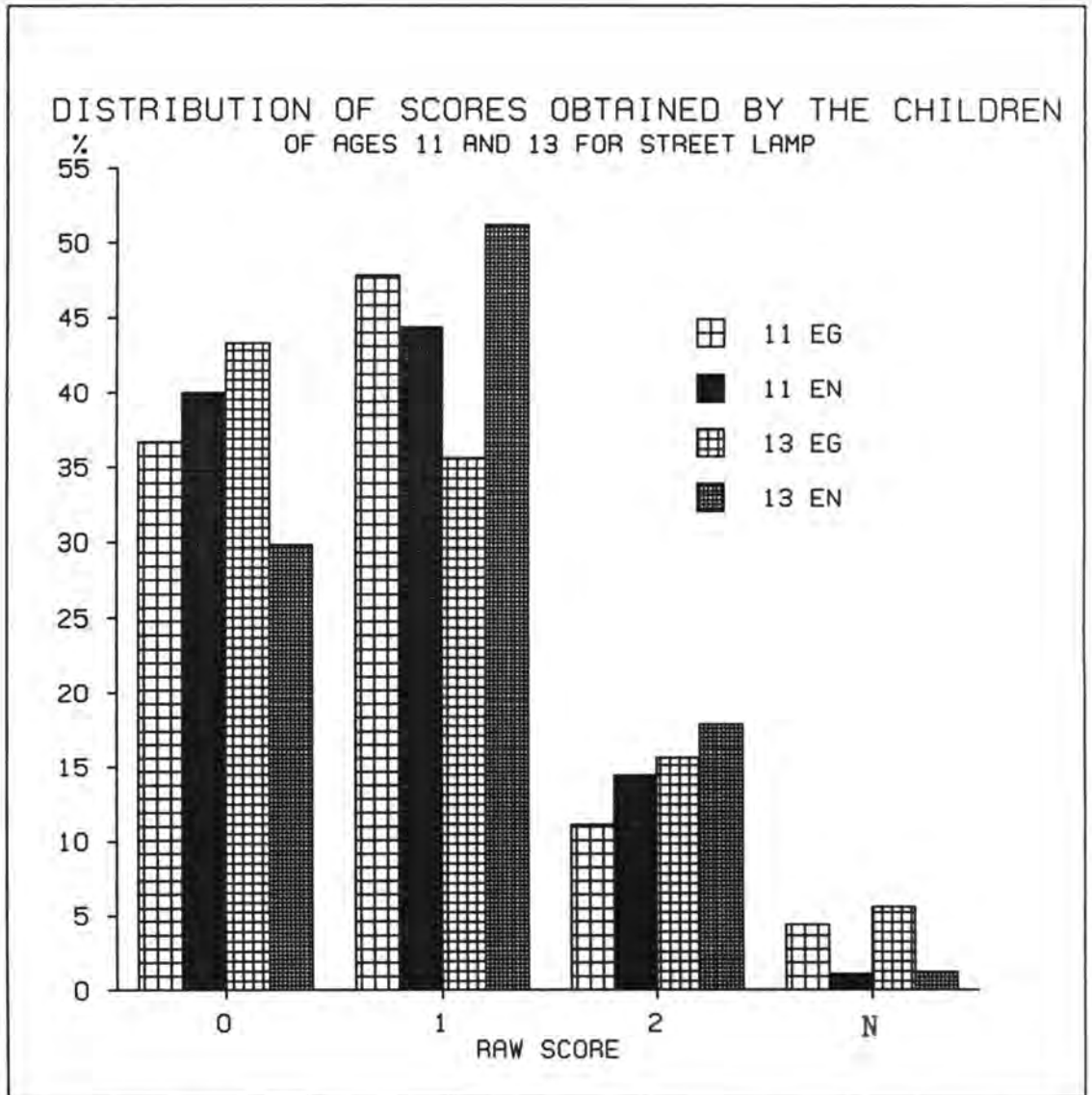
In the three questions 'Field of Grass', 'Street Lamp' and 'Senses', the variations in the children's pattern of answer were very clear. At age 11 a high mean mark of 1.21 (60.5%) in 'Senses' obtained by the Egyptians and of 1.09 (54.5%) by the English was reduced to 0.73 (36.5%) and 0.70 (35.0%) by the Egyptians, and to ⁵⁷0.57 (28.5%) and 0.73 (36.5%) by the English in 'Field of Grass' and 'Street Lamp' respectively. The same pattern of decreasing performance was displayed by the children of 13 year old. In 'Senses' the mean score for the Egyptians

FIG. 7.1



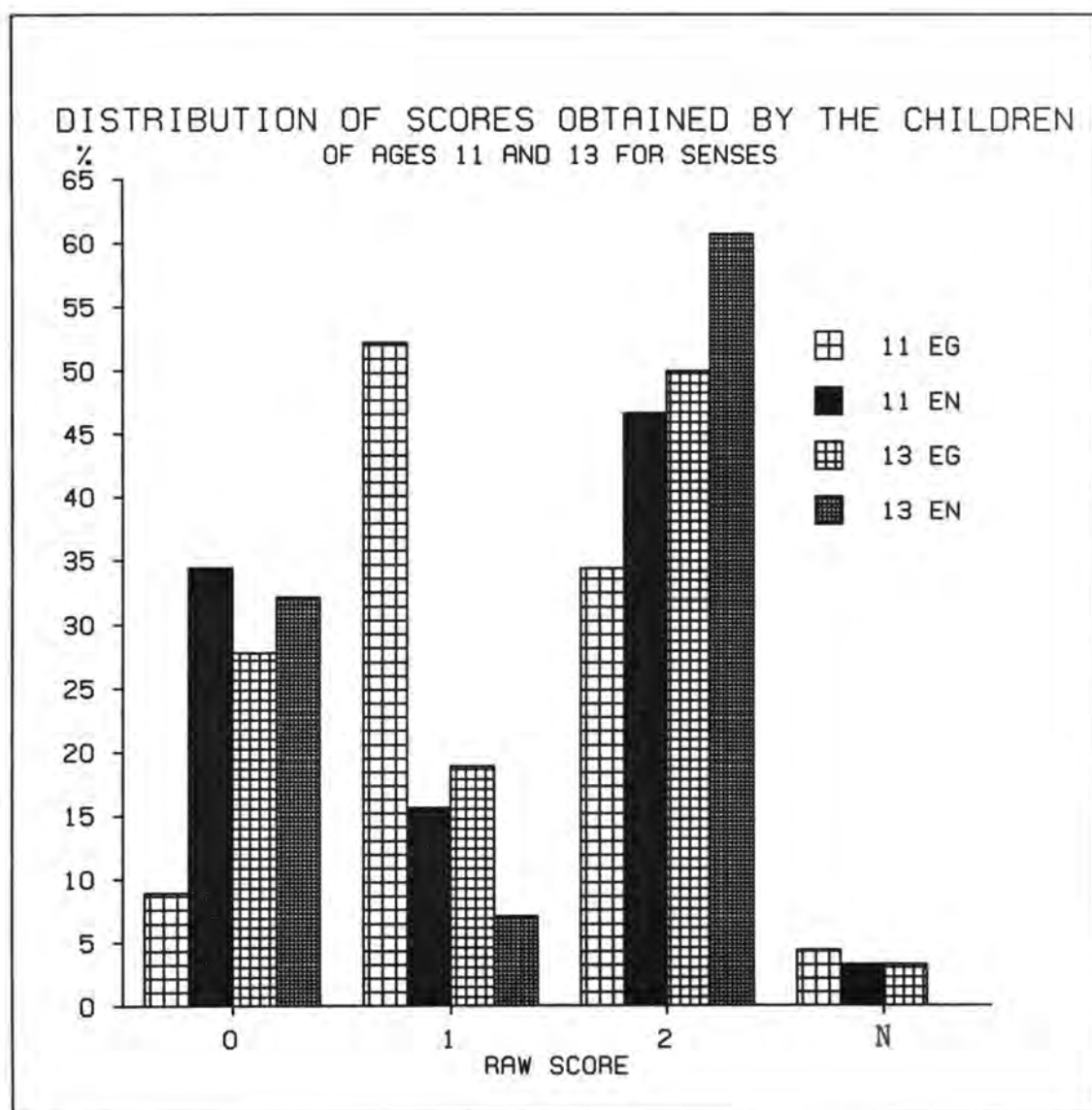
N = No answer

FIG. 7.2



N=No answer

FIG. 7.3



N = No answer

was 1.19 (59.5%) and for the English 1.29 (64.5%), which was also reduced to 0.77 (38.5%), and 0.67 (33.5%) for the Egyptians, and 0.74 (37.0%) and 0.87 (43.5%) in 'Field of Grass', and 'Street Lamp' respectively.

In 'Senses' for the 11-year-old Egyptians S.D. = 0.66 (with S.E. = 0.07), for the English of the same age S.D. = 0.92 (with S.E. = 0.10), for 13-year-old Egyptians S.D. = 0.89 (with S.E. = 0.09), and for the English of age 13 S.D. = 0.93 (with S.E. = 0.10). In 'Field of Grass' for the 11-year-old Egyptians S.D. = 0.73 (with S.E. = 0.08), for the English of the same age S.D. = 0.64 (with S.E. = 0.07), for 13-year-old Egyptians S.D. = 0.74 (with S.E. = 0.08), and for the English of age 13 S.D. = 0.73 (with S.E. = 0.08), which was approximately typical of that shown in 'Street Lamp'. Figures 7.1, 7.2, and 7.3 illustrate the results of the two age groups of the two countries.

Table 7.2 shows the full results of the three questions 'Beak Shapes', 'Grasshoppers', and 'Goosegrass', which were allotted three marks each. It could be deduced from the table that the best performance of all children was manifested in 'Beak Shapes'. As regards this question at age 11 over 80 per cent of the Egyptians and more than half of the English succeeded in choosingⁿ the two birds that would eat the same kind of food, but only over half of the Egyptians and 45 per cent of the English were able to explain their classifications. At age 13, about three

Table (7.2)

Responses of the Children of Ages 11 and 13 to Three Biological
Questions Allotted 3 Marks Each in Number and Percentage

Ques- tions	Age	Sub. Loc.	Scores										\bar{X}	S.D	S.E
			0		1		2		3		P				
			N.	%	N.	%	N.	%	N.	%	N.	%			
Beak	11	Eg	12	13.3	27	30.0	41	45.6	7	7.8	3	3.3	1.44	0.86	0.09
		En	39	43.3	7	7.8	31	34.4	10	11.1	3	3.3	1.10	1.12	0.12
Shapes	13	Eg	18	20.0	9	10.0	41	45.6	18	20.0	4	4.4	1.61	1.07	0.11
		En	33	39.3	5	6.0	38	45.2	8	9.5	-	-	1.25	1.09	0.12
Grass- hoppers	11	Eg	22	24.4	41	45.6	16	17.8	-	-	11	12.2	0.81	0.72	0.08
		En	46	51.1	32	55.6	7	7.8	-	-	5	5.6	0.51	0.64	0.07
	13	Eg	10	11.1	27	30.0	35	38.9	13	14.4	5	5.6	1.51	0.94	0.10
		En	41	48.8	28	33.3	8	9.5	6	7.1	1	1.2	0.74	0.91	0.10
Goose- grass	11	Eg	24	26.7	38	42.2	17	18.9	4	4.4	7	7.8	0.93	0.85	0.09
		En	49	54.4	24	26.7	14	15.6	2	2.2	1	1.1	0.64	0.83	0.09
	13	Eg	27	30.0	18	20.0	26	28.9	13	14.4	6	6.7	1.21	1.10	0.12
		En	29	34.5	26	31.0	24	28.6	5	6.0	-	-	1.06	0.94	0.10

quarters of the Egyptians and 60 per cent of the English predicted correctly the two birds, but 65 per cent of the Egyptians and 55 per cent of the English managed to explain their classifications. In 'Grasshoppers' none of the children of age 11 was able to give three possible hypotheses based on their understanding of the concept of biological adaptation of 'Grasshoppers' to their environment. At age 13, 14.4 per cent of the Egyptians and 7.1 per cent of the English managed to predict and relate three acceptable hypotheses to the situation. The rate of irrelevant explanations was high among the English of both ages, most of whom built their answers on ^ep~~a~~cocks rather than 'Grasshoppers'. A similar performance was demonstrated in the question 'Goosegrass', with a relatively higher mean scale for all age groups except the Egyptians of age 13 of whom the rate of irrelevant response was the highest among these three questions.

Table 7.3 shows the results of the three questions 'Food Web', 'Gas Balance', and 'Tree Section', each of which was allotted 6 marks. For the question 'Food Web', only one Egyptian child of age 11 out of all children of both ages and cultures managed to predict the correct increase and decrease of the six populations hypothetically affected in the 'Food Web'. Percentage of correct predictions are shown in the table since each correct prediction allocated one mark. In the question 'Gas Balance', the best performance was achieved by the Egyptians of age 11. But because the question involved

Table (7.3)

Responses of the Children of Ages 11 and 13 to Three Biological
Questions Allotted 6 Marks Each in Percentage

Ques- tions	Age	Sub. Loc.	Scores							\bar{X}	S.D	S.E	
			0	1	2	3	4	5	6				P
Food	11	Eg	11.1	20.0	14.4	13.3	16.7	14.4	1.1	8.9	2.34	1.79	0.19
		En	8.9	24.4	27.8	11.1	20.0	4.4	-	3.3	2.16	1.43	0.15
Web	13	Eg	16.7	7.8	17.8	33.3	6.7	7.8	-	10.0	2.09	1.57	0.17
		En	3.6	25.0	23.8	16.7	19.0	8.3	-	3.6	2.41	1.44	0.16
Gas	11	Eg	13.3	13.3	14.4	21.1	10.0	20.0	1.1	6.7	2.52	1.81	0.19
		En	28.9	16.7	12.2	10.0	7.8	7.8	3.3	13.3	1.61	1.84	0.19
Balance	13	Eg	20.0	15.6	17.8	13.3	2.2	25.6	2.2	3.3	2.41	1.96	0.21
		En	29.8	10.7	16.7	14.3	4.8	14.3	3.6	6.0	1.99	1.94	0.21
Tree	11	Eg	10.0	12.2	34.4	22.2	5.6	-	-	15.6	1.70	1.23	0.13
		En	48.9	37.8	4.4	-	2.2	-	-	6.7	0.56	0.78	0.08
Section	13	Eg	26.7	38.9	15.6	10.0	2.2	-	-	6.7	1.09	1.05	0.11
		En	58.3	21.4	13.1	3.6	2.4	-	-	1.2	0.68	1.00	0.11

the processes of respiration and photosynthesis, the performance of English children of both ages was considerably higher than theirs in the question 'Stream', though it was still lower in terms of mean mark than that of the Egyptians. A high percentage of the correct answers was relating the two gases without mentioning the two terms of respiration and photosynthesis, and a very small proportion gave explanations to their suggested observations. The lowest performance of the children among these three questions was demonstrated in 'Tree Section', though again the Egyptian 11-year-olds were the most successful of all subjects. But as a whole, the children who managed to predict the age of the tree in one and/or both situations did not give relevant explanations, with the exception of a small proportion who gave partially relevant reasons. A further small proportion of children gave correct relevant explanations but they were mathematically wrong in their predictions of the age of the tree.

7.1.2 Chemical Concepts

Table 7.4 shows the comparative results of the performance of all children tested on four questions allotted three marks each. In terms of mean score the results obtained revealed that Egyptian and English children of age 13 were consistent and nearly similar in their performance on the three questions 'Nail', 'Solution' and 'Fountain', despite the apparent little

Table (7.4)

Responses of the Children of Ages 11 and 13 to Four Chemical
Questions Allotted 3 Marks Each in Number and Percentage

Ques- tions	Age	Sub. Loc.	Scores										\bar{X}	S.D	S.E
			0		1		2		3		P				
			N.	%	N.	%	N.	%	N.	%	N.	%			
Nail	11	Eg	37	41.1	25	27.8	17	18.9	8	8.9	3	3.3	0.92	1.00	0.11
		En	39	43.3	26	28.9	20	22.2	5	5.6	-	-	0.90	0.94	0.10
	13	Eg	19	21.1	28	31.1	26	28.9	16	17.8	1	1.1	1.42	1.03	0.11
		En	33	39.3	16	19.0	23	27.4	12	14.3	-	-	1.17	1.11	0.12
Solu- tion	11	Eg	26	28.9	44	48.9	12	13.3	-	-	8	8.9	0.76	0.68	0.07
		En	27	30.0	37	41.1	24	26.7	1	1.1	1	1.1	0.98	0.79	0.08
	13	Eg	1	1.1	43	47.8	45	50.0	1	1.1	-	-	1.51	0.55	0.06
		En	8	9.5	39	46.4	30	55.7	5	6.0	2	2.4	1.36	0.77	0.08
Foun- tian	11	Eg	8	8.9	34	37.8	28	31.1	9	10.0	11	12.2	1.30	0.92	0.10
		En	16	17.8	29	32.2	26	28.9	14	15.6	5	5.6	1.37	1.01	0.11
	13	Eg	10	11.1	31	34.4	30	33.3	11	12.2	8	8.9	1.38	0.94	0.10
		En	10	11.9	36	42.9	25	29.8	12	14.3	1	1.2	1.45	0.90	0.10
Phos- phorus	11	Eg	51	56.7	23	25.6	4	4.4	-	-	12	13.3	0.34	0.56	0.06
		En	70	77.8	15	16.7	5	5.6	-	-	-	-	0.28	0.56	0.06
	13	Eg	62	68.9	14	15.6	14	15.6	-	-	-	-	0.47	0.75	0.08
		En	66	78.6	11	13.1	6	7.1	-	-	1	1.2	0.27	0.59	0.06

variations in the mean mark (47%, 50% and 46% for the Egyptians as against 39%, 45% and 48% for the English respectively). In contrast the performance of the children of age 11 on 'Nail' and 'Solution' was comparatively low (30.6% and 25% for the Egyptians, and 30% and 32.6% for the English). On 'Fountain' their mean score increased to 43% and 45.6% respectively, which almost matched the performance of 13-year-old subjects on the same question.

The level of performance of all children on 'Phosphorus' proved to be the lowest among these four questions. At age 11, 30 per cent of the Egyptians and just over 20 per cent of the English predicted successfully that the mass of the contents of the flask would not change before and after the reaction, but only about 5 per cent were able to provide partial interpretation of their prediction. Similar percentages of the 13-year-olds gave the same answer with a little higher proportion of those who succeeded in giving partially relevant reasons for their prediction.

The results of the two questions 'Melting Ice' and 'Reactivity', allotted five marks each, are shown in table 7.5. From the table the inconsistency of the children performance on the two questions is very obvious. In 'Melting Ice' the rate of wrong answers and of no response was very low. In addition, regardless of the little difference in mean score in favour of the 13-year-old

Table (7.5)

Responses of the Children of Ages 11 and 13 to the Questions
"Melting Ice" and "Reactivity" in Percentage

Ques- tions	Age	Sub. Loc.	Sores							\bar{X}	S.D	S.E
			0	1	2	3	4	5	P			
Melt- ing Ice	11	Eg	2.2	11.1	34.4	32.2	12.2	4.4	3.3	2.48	1.15	0.12
		En	-	13.3	28.9	52.2	3.3	1.1	1.1	2.47	0.85	0.09
	13	Eg	4.4	4.4	11.1	44.4	24.4	7.8	3.3	2.77	1.25	0.13
		En	2.4	6.0	16.7	66.7	7.1	1.2	-	2.74	0.82	0.09
React- ivity	11	Eg	21.1	22.2	-	7.8	-	-	48.9	0.46	0.85	0.09
		En	51.1	1.1	-	-	-	-	47.8	0.01	0.11	0.01
	13	Eg	26.7	11.1	15.6	6.7	23.3	7.8	8.9	1.94	1.81	0.19
		En	67.9	3.6	2.4	-	4.8	1.2	20.2	0.33	1.05	0.11

Egyptians, the pattern of response of all children was nearly identical. The high proportion of children who obtained three marks reflected their understanding of the classification of the sequence of the states of water by heating and cooling, but they were unable to comprehend that two states of change might take place in one stage or

section. So, they mentioned only one state in the two sections requiring two states of change. This maximum level of performance (mentioning five states in the three sections of the question) was achieved by a very small proportion of the children who obtained five marks, while a relatively higher proportion mentioned four states in their proper sections, and thereby scored four marks.

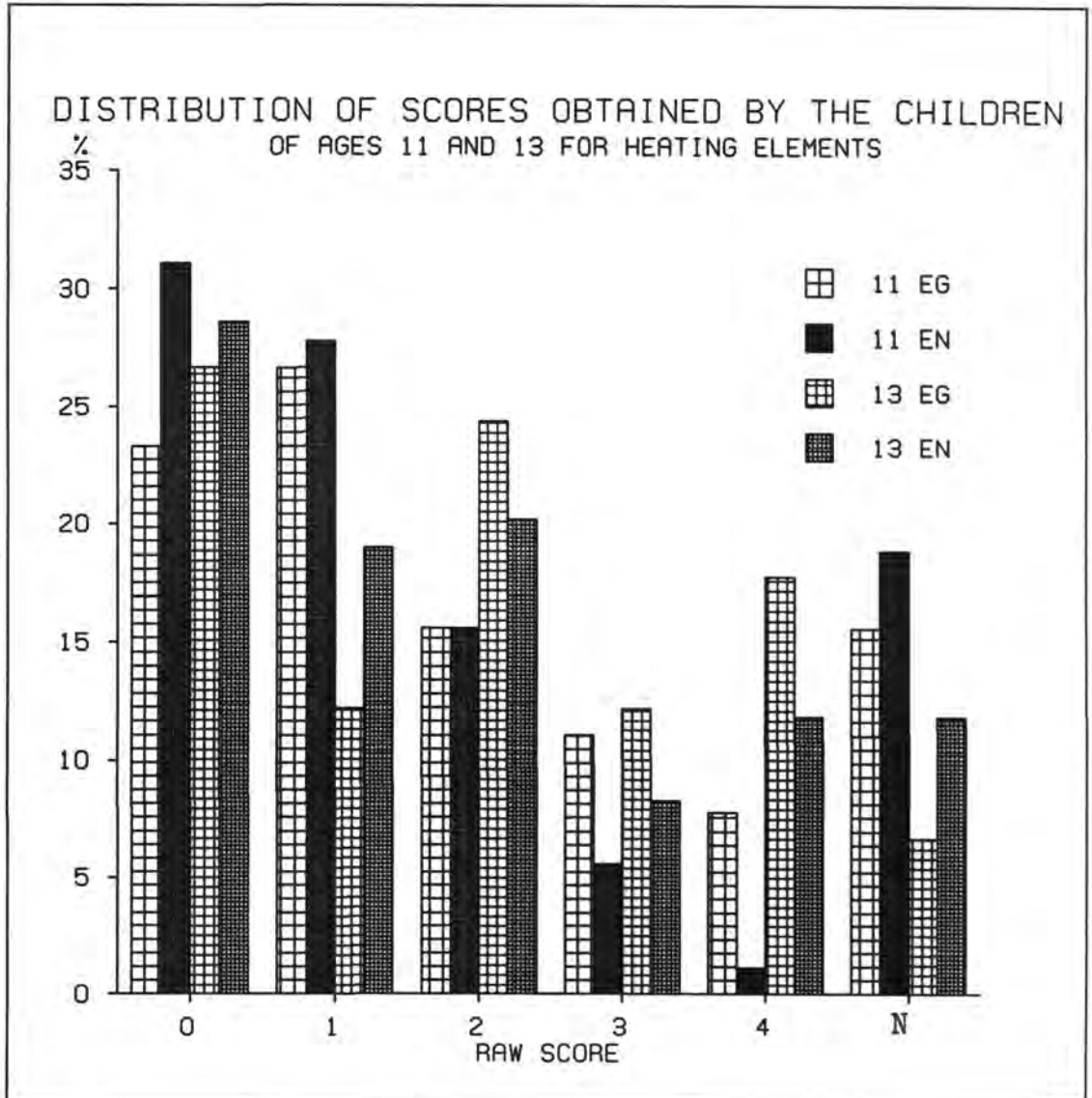
The table also revealed that the level of the children's performance on 'Reactivity' proved to be the lowest among the 37 questions of the whole test. Except the Egyptians of age 13, whose mean score of 38.8% was relatively high, all children demonstrated such a low performance that their mean score was less than 1% (0.09% for the Egyptians of age 11, $\frac{2-83}{2}$ % (0.001%) for the English of the same age, and 0.07% for the English children of age 13). The results of the question revealed the highest rate of no response demonstrated by the children of age 11, where nearly half of them did not attempt to answer.

Compared to the results of 'Reactivity', the performance of the children on the question 'Heating Elements' was enormously high. At age 11 a third of the Egyptians and over a fifth of the English demonstrated a considerable understanding of the information given in the table on which they built their answers, though about half of this proportion confined their answers to only one of the two parts of the question. A further quarter of the

Egyptian and English children referred only to the general aspect of zinc as a metal without interpreting its relevant properties, and even those were either confined to one part or repeating the same explanations in the other. Full marks were gained by 7.8 per cent of the Egyptians and 1.1 per cent of the English. The mean score for the Egyptians was 1.22 (30.5%) with S.D. = 1.29, S.E. = 0.14, and for the English 0.80 (20%) with S.D. = 0.97, S.E. = 0.10. As for age 13, the full mark rate was higher than that achieved at age 11 (17.8 per cent for the Egyptians and 11.9 per cent for the English). Yet, the pattern of response tended to be identical of that of the children of age 11. Over half of the Egyptians and 40 per cent of the English used the information given with varying degrees of success in stating relevant explanations. The mean score of the Egyptians was 1.69 (42%) with S.D. = 1.49, S.E. = 0.16 and for the English 1.32 (33%) with S.D. = 1.39 and S.E. = 0.15. Figure 7.4 illustrates the comparative distribution of the marks gained by all children.

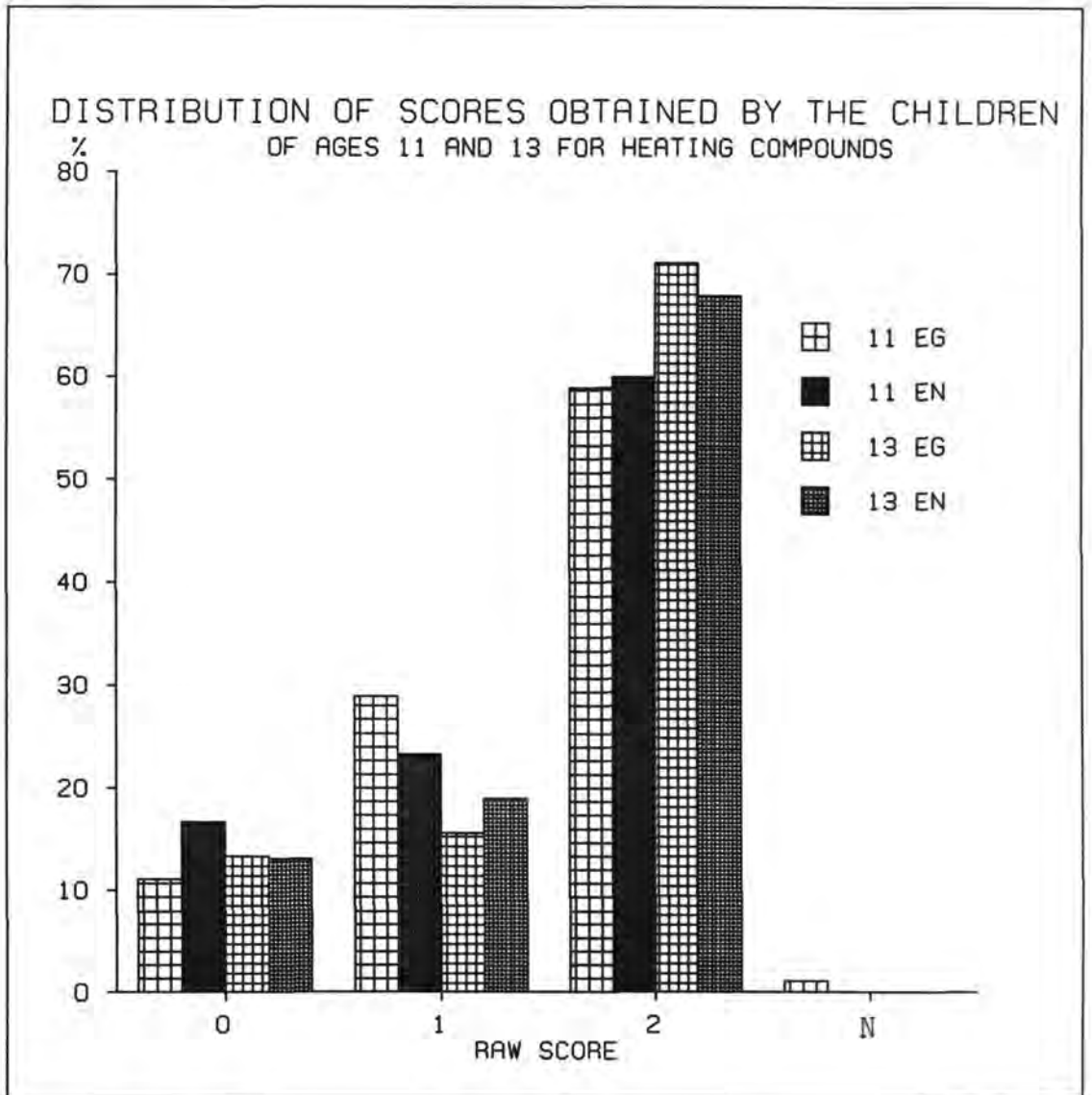
Figure 7.5 indicates that the level of performance on the question 'Heating Compounds' was higher than that on 'Heating Elements'. At age 11 about 60 per cent of the children of both locations chose the correct answer in the two parts of the question, and about a further quarter did the same in either part. Except one Egyptian child all children attempted to answer the question. The mean score for the Egyptians was 1.47 (73.5%) with S.D. = 0.71, S.E.

FIG. 7.4



N=No answer

FIG. 7.5



N = No answer

= 0.07, and for the English 1.43 (71.5%) with S.D. = 0.77, S.E. = 0.08. A slightly higher performance was achieved by the children of age 13. About 70 per cent of the children of both cultures selected the correct answer in the two parts of the question, and a further percentage of 15.6 of the Egyptians and of 19 of the English failed in either of the two parts. All children attempted to answer the question. The mean score for the Egyptians was 1.58 (79%) with S.D. = $\underline{0.72}$ ⁷², S.E. = 0.08, and for the English 1.55 (77.5%) with S.D. = 0.72, S.E. = 0.08.

In the question 'Acid and Alkali', which assessed the concept of the PH of an acid when reacting with other solutions, there was a big difference in the level of performance between the Egyptian and English children of age 11, where 51.1 per cent of the Egyptians and 26.7 per cent of the English succeeded in selecting the correct prediction that the addition which would not alter the acidity was of the same nitric acid. Moreover, 8 per cent of the English children gave multiple answers and this was done by only 1.1 per cent of the Egyptians.

Most of the wrong answers were concentrated on the choice of water as the addition that would not change the acidity. For the Egyptians the mean score was 0.51 (51%) with S.D. = $\overset{50}{0.50}$ and S.E. = $\overset{0.05}{\underline{0.05}}$ and for the English 0.27 (27%) with S.D. = 0.45, S.E. = 0.05.

At age 13, the difference was reduced, though still in favour of the Egyptians of whom 57.8 per cent as against

42.9 per cent of the Egyptian chose the correct answer. Multiple response was given by two children of each group, while 4.4 per cent of the Egyptians and 1.2 per cent of the English did not respond. The mean score of the Egyptians was 0.58 (58%) with S.D. = 0.50 and S.E. = 0.05 as against 0.43 (43%) with S.D. = 0.50 and S.E. = 0.05.

Table 7.6 indicates that the lowest performance on the question 'Coal and Oil' was displayed by the 11-year-old Egyptian children who demonstrated the highest rate of irrelevant response to this question. The rest of the children tested were roughly similar in their type of response. For all children the no response rate increased from part (1) to part (3) with a gradually decreasing percentage of relevant answers.

Table (7.6)

Distribution of Scores Obtained by Children of Ages 11 and 13 on "Coal and Oil" in Percentage

Age	Sub.	Scores								\bar{X}	S.D	S.E
		Loc.	0	1	2	3	4	5	6	P		
11	Eg	37.8	22.2	17.8	10.0	2.2	1.1	-	8.9	1.02	1.20	0.13
	En	16.7	21.1	30.0	11.1	12.2	1.1	2.2	5.6	1.82	1.47	0.15
13	Eg	21.1	10.0	27.8	10.0	18.9	4.4	2.2	5.6	2.07	1.68	0.18
	En	17.9	26.2	19.0	15.5	13.1	3.6	2.4	2.4	1.95	1.58	0.17

7.1.3 Physical Concepts

Table 7.7 shows the distribution of scores obtained by all subjects on seven questions allotted three marks each. When computed together the results of these seven questions revealed some general findings:-

1 - The overall performance of all children tended to be low in terms of mean score 0.83 (27.6%).

2 - There were very slight variations in this overall low performance.

3 - The English children of age 13 demonstrated the relatively best performance, where they achieved the highest score in four questions (Freezing, Watering Can, Car Tyre, and Snails) and the second best in the other three. Even in terms of the overall mean score they came first with 1.01 (33.7%) as against 0.91 (30.3%) for the Egyptians of the same age, 0.67 (22.3%) for the English of age 11, and 0.72 (24%) for the Egyptians of age 11.

4 - Relevantly, the overall mean score of the English of both ages almost equalled that of the Egyptians - 0.84 (28%) as against 0.82 (27.3%) respectively.

5 - The rate of wrong and irrelevant answers in the overall performance, with the exception of 'Snails' was very high (48%).

6 - The rate of maximum score, again with the exception of 'Snails', and 'Wat^ering Can' was generally low (e.g. for

Table (7.7)

Responses of the Children of Ages 11 and 13 to Seven Physical
Questions Allotted 3 Marks Each in Number and Percentage

Questions	Age	Sub. Loc.	Scores										\bar{X}	S.D	S.E
			0		1		2		3		P				
			N.	%	N.	%	N.	%	N.	%	N.	%			
Freez- ing	11	Eg	40	44.4	27	30.0	13	14.4	-	-	10	11.1	0.59	0.73	0.08
		En	63	70.0	10	11.1	13	14.4	2	2.2	2	2.2	0.47	0.82	0.09
	13	Eg	66	73.3	12	13.3	10	11.1	-	-	2	2.2	0.36	0.68	0.07
		En	44	52.4	20	23.8	18	21.4	2	2.4	-	-	0.74	0.88	0.10
Water- ing Can	11	Eg	44	48.9	22	24.4	12	13.3	8	8.9	4	4.4	0.78	0.99	0.11
		En	45	50.0	21	23.3	13	14.4	6	6.7	5	5.6	0.72	0.95	0.10
	13	Eg	40	44.4	27	30.0	11	12.2	11	12.2	1	1.1	0.91	1.04	0.11
		En	26	31.0	29	34.5	7	8.3	22	26.2	-	-	1.30	1.17	0.13
Torch	11	Eg	49	54.4	32	35.6	-	-	-	-	9	10.0	0.36	0.48	0.05
		En	75	83.3	9	10.0	1	1.1	-	-	5	5.6	0.12	0.36	0.04
	13	Eg	26	28.9	48	53.3	14	15.6	-	-	2	2.2	0.84	0.67	0.07
		En	39	46.4	32	38.1	10	11.9	-	-	3	3.6	0.62	0.69	0.08
Car Tyre	11	Eg	35	38.9	32	35.6	12	13.3	-	-	11	12.2	0.62	0.71	0.08
		En	39	43.3	37	41.1	5	5.6	2	2.2	7	7.8	0.59	0.70	0.07
	13	Eg	21	23.3	39	43.3	27	30.0	1	1.1	2	2.2	1.07	0.78	0.08
		En	17	20.2	34	40.5	21	25.0	6	7.1	6	7.1	1.12	0.90	0.10

Continued Table 7.7

Ques- tions	Age	Sub. Loc.	Scores										\bar{X}	S.D	S.E
			0		1		2		3		P				
			N.	%	N.	%	N.	%	N.	%	N.	%			
Snails	11	Eg	13	14.4	35	38.9	22	24.4	18	20.0	2	2.2	1.48	1.00	0.11
		En	2	2.2	55	61.1	3	3.3	30	33.3	-	-	1.68	0.97	0.10
	13	Eg	11	12.2	35	38.9	14	15.6	30	33.3	-	-	1.70	1.07	0.11
		En	8	9.5	34	40.5	2	2.4	40	47.6	-	-	1.88	1.12	0.12
Salty Water	11	Eg	27	30.0	32	35.6	18	20.0	7	7.8	6	6.7	0.99	0.94	0.10
		En	38	42.2	25	27.8	16	17.8	5	5.6	6	6.7	0.80	0.93	0.10
	13	Eg	40	44.4	25	27.8	16	17.8	5	5.6	4	4.4	0.80	0.93	0.10
		En	36	42.9	27	32.1	11	13.1	8	9.5	2	2.4	0.87	0.98	0.11
Boil- ing Pota- toes	11	Eg	63	70.0	15	16.7	2	2.2	-	-	10	11.1	0.21	0.46	0.05
		En	65	72.2	12	13.3	6	6.7	1	1.1	6	6.7	0.30	0.64	0.07
	13	Eg	34	37.8	41	45.6	10	11.1	-	-	5	5.6	0.68	0.67	0.07
		En	50	59.5	19	22.6	13	15.5	1	1.2	1	1.2	0.57	0.80	0.09

the Egyptians only one child obtained full marks once out of four questions, while none of all children gained maximum score in 'Torch').

7 - The highest rate of no response was given by the Egyptians of age 11 (8.2%).

8 - The questions 'Freezing', 'Torch' and boiling 'Potatoes' proved to be very difficult for all children to answer, and the pattern of the children's low performance on the three questions was approximately similar.

9 - On two questions (Freezing and Salty Water) the 11-year-old Egyptians performed higher than their 13-year-old country fellows, and higher than all children on 'Salty Water'.

From the children's responses to the question 'See-Saw', which involved the concept of the turning effect of a force about a point, it appeared that the Egyptians performed less than the English in their application of this concept to the presented situation. At age 11 exactly a third of the Egyptians and 44.4 per cent of the English selected the correct answer, and this was done by 55.6 per cent of the Egyptians of age 13 and 58.3 per cent of the English of the same age.

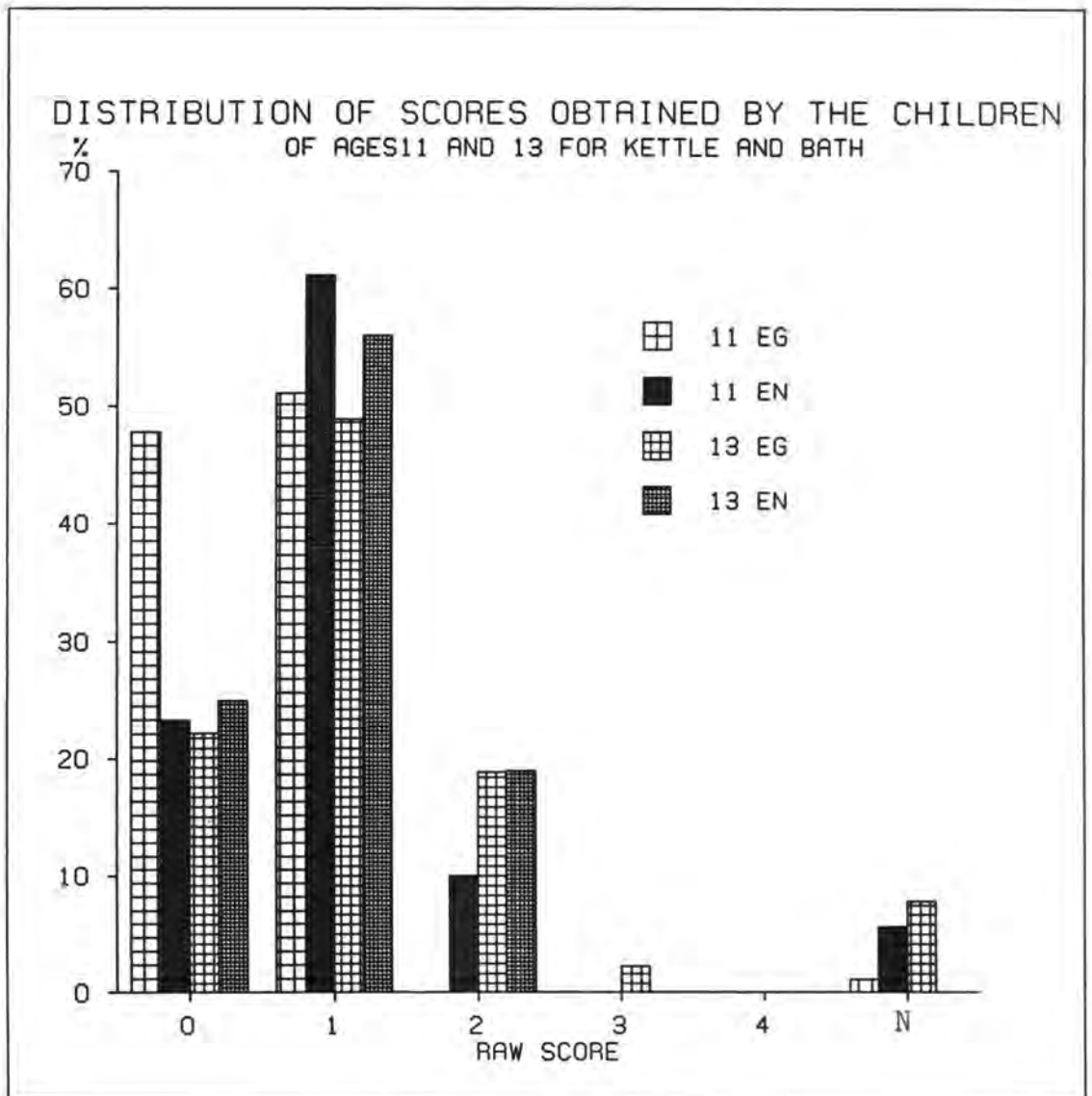
A similar pattern of response was repeated in the question 'Man' despite the overall slightly lower performance than that on the previous question. Only 28.9 per cent of the Egyptians of age 11 and 36.7 per cent of

the English of the same age opted for the correct answer with a high rate of no response given by the Egyptians (13.3 per cent). The percentage of correct answers increased at age 13 where 46.7 per cent of the Egyptians and 51.2 per cent of the English selected the correct answer with only one Egyptian child who did not attempt to answer.

Figure 7.6 indicated the same relative superiority of the English over the Egyptians (especially at age 11 in this case) despite the very low overall performance on the question 'Kettle and Bath'. None of the children managed to gain a full mark and only two Egyptian children of age 13 were able to score three marks, while none of their country fellows of age 11 succeeded in obtaining even two marks. For the Egyptian of age 11 the mean score was 0.51 (13%) with S.D. = 0.50, S.E. = 0.05, and for the English of their age 0.81 (20%) with S.D. = 0.60, S.E. = 0.06. At age 13 the mean score for the Egyptians was 0.93 (23%) with S.D. = 0.76, S.E. = 0.08, and for the English 0.94 (23.5%) with S.D. = 0.67, S.E. = 0.07.

The same pattern with a more considerable difference was again repeated in the question 'Sources of Energy'. At age 11 the performance of the English was nearly twice that of the Egyptians and the same can be said about the children of age 13.

FIG. 7.6



N = No answer

In terms of the means score, the Egyptians of age 11 achieved 0.57 (28.5%) with S.D. = 0.74, S.E. = 0.08 as against 0.96 (48%) obtained by the 11-year-old English children. At age 13 it was 0.69 (34.5%) with S.D. = 0.84, S.E. = 0.09 for the Egyptians, and 1.13 (56.5%) with S.D. = 0.88, S.E. = 0.10 for the English (Figure 7.7).

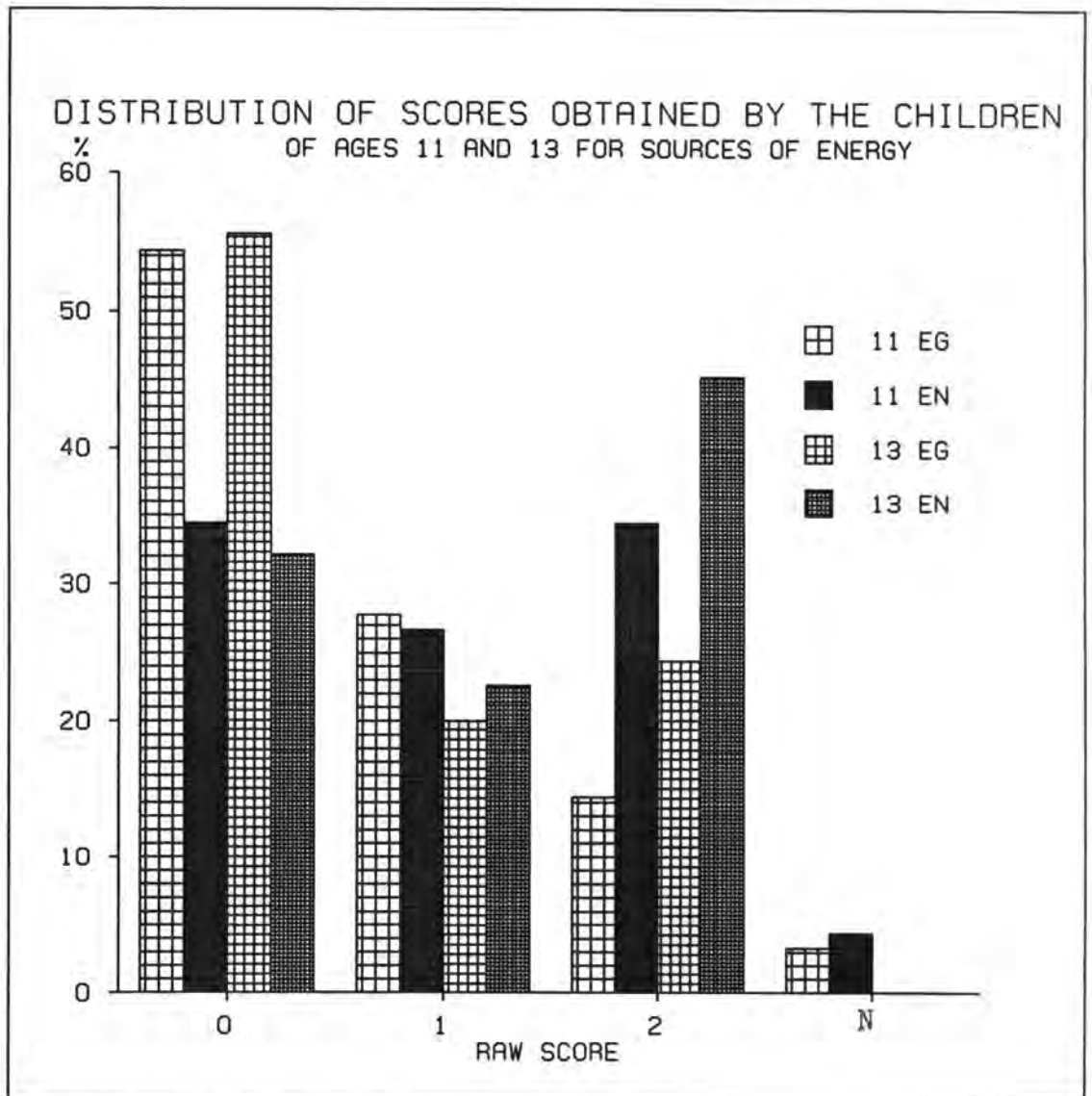
In the question 'Electro-Magnet', while the situation was reversed in favour of the 13-year-old Egyptians, the English children of age 11 maintained their superiority over their Egyptian rivals. Table 7.8 shows the full results of this question.

Table (7.8)

Distribution of Scores Obtained by Children of Ages 11 and 13 on "Electro-Magnet" in Percentage

Age	Sub.	Sores							\bar{X}	S.D	S.E	
		Loc.	0	1	2	3	4	5				6
11	Eg	42.2	10.0	26.7	4.4	7.8	-	-	8.9	1.08	1.29	0.14
	En	33.3	8.9	27.8	7.8	6.7	2.2	-	13.3	1.26	1.40	0.15
13	Eg	18.9	3.3	17.8	3.3	25.6	8.9	14.4	7.8	2.82	2.16	0.23
	En	22.6	10.7	22.6	20.2	10.7	-	-	13.1	1.60	1.46	0.16

FIG. 7.7



N = No answer

RESPONCES OF THE 15-YEAR-OLD CHILDREN

7.2.1 Biological Concepts

The results obtained revealed that in the question 'Cyclops', 12.2 per cent of the Egyptian sample and 8.6 per cent of the English sample managed to identify and relate the two interdependent effects of the change in prediction and the change in the food supply. More than half the children of the two sample succeeded in identifying one effect only with various degrees of logical explanations. The percentage of the score is shown in Table 7.9.

The children's responses to the question 'Grasshoppers' did not follow the same pattern of relatively high performance they achieved in 'Cyclops'. Only 2.2 per cent of the Egyptians and 3.4 per cent of the English succeeded in relating suggested hypotheses to the observations, while 12.2 per cent of the Egyptians and 27.6 per cent of the English either failed to infer acceptable reasons, or to respond at all as illustrated in Table 7.10.

The question 'Onion Plant' proved to be the most difficult in this biological set for the Egyptians to answer. None of the Egyptian children managed to obtain the maximum score, though about a quarter of them mentioned both natural variation and environmental factors in their responses without specification. More than a quarter of the Egyptians gave only one reason, less than a

Table (7.9)
Egyptian and English Children's Responses to "Cyclops"
in number and percentage

Sub. _____		Scores										\bar{X} S.D S.E		
		0		1		2		3		P				
Loc.	_____		_____		_____		_____		_____					
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	24	26.7	8	8.9	38	42.2	11	12.2	9	10	1.30	1.1	0.12	
En	18	31.0	5	8.6	29	50.0	5	8.6	1	1.7	1.35	1.04	0.14	

Table (7.10)
Egyptian and English Children's Responses to
"Grasshoppers" in number and percentage

Sub. _____		Scores										\bar{X} S.D S.E		
		0		1		2		3		P				
Loc.	_____		_____		_____		_____		_____					
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	11	12.2	36	40	36	40	2	2.2	5	5.6	1.27	0.78	0.08	
En	16	27.6	24	41.4	14	24.1	2	3.4	2	3.4	1.00	0.84	0.11	

fifth of them responded irrelevantly, and more than a quarter gave no response. Exactly 3.4 per cent of the English children obtained a maximum score. Only 6.9 per cent were able to account for the two variations without specification. Nearly half the English mentioned only one of the two factors. More than a third failed to predict any accepted factor, and about 10.0 per cent gave no answer. The full results are shown in Table 7.11.

Table (7.11)
Egyptian and English Children's Responses to "Onion
Plant" in number and percentage

Sub.		Scores										\bar{X}	S.D	S.E
		0		1		2		3		P				
Loc.		No.	%	No.	%	No.	%	No.	%	No.	%			
Eg	16	17.8		25	27.8	23	25.6	-	-	26	28.9	0.79	0.83	0.09
En	20	34.5		26	44.8	4	6.9	2	3.4	6	10.3	0.69	0.75	0.10

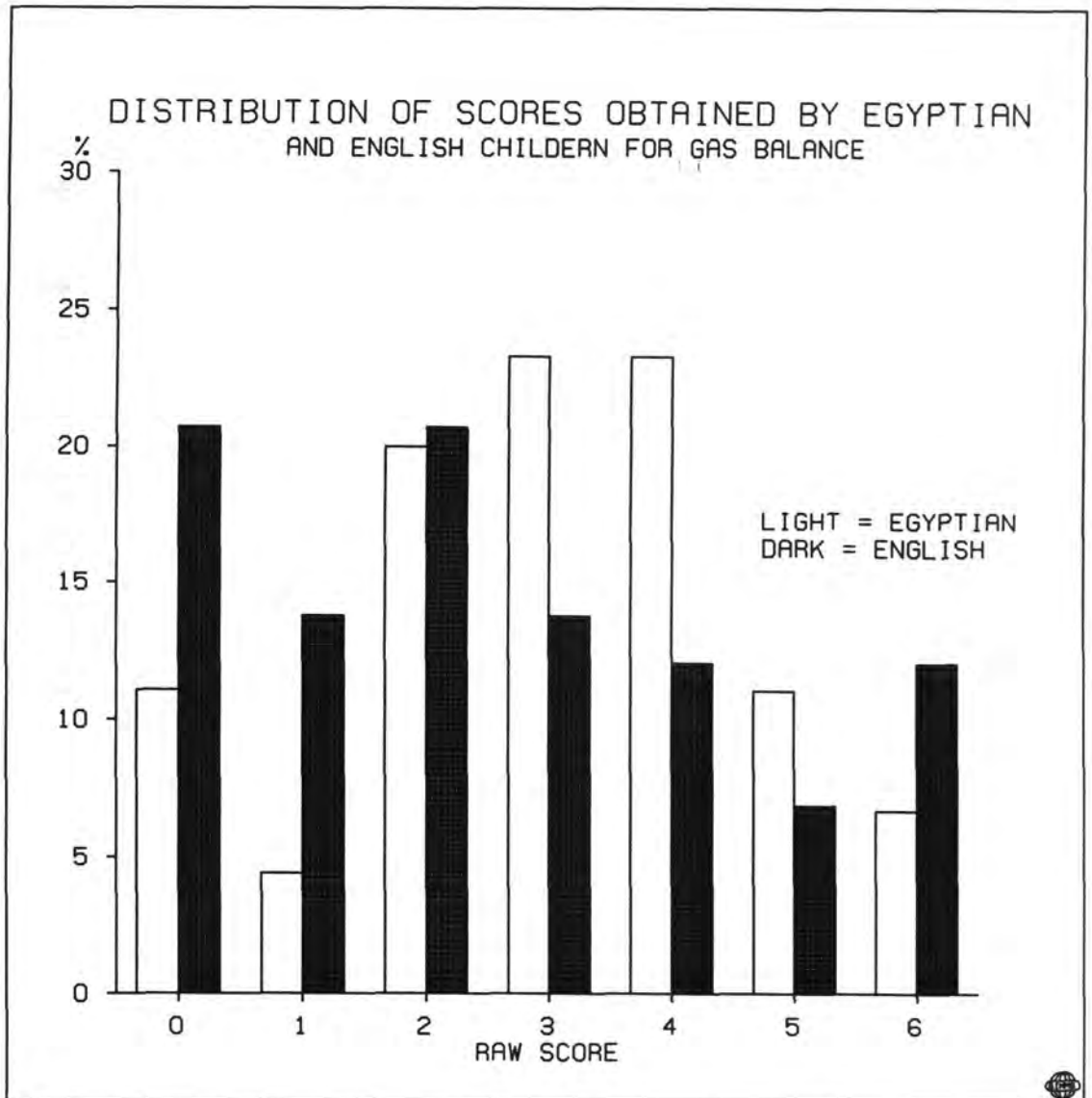
In the question 'Gas Balance', about a fifth of both Egyptian and English children succeeded in predicting the gas exchange taking place due to both respiration and photosynthesis. 46.6 per cent of the Egyptians and 25.9 per cent of the English managed to demonstrate considerable understanding of the processes of respiration and photosynthesis without linking the two processes.

More than 20 per cent of each nationality gave responses connected only to the gas exchange involved in respiration. 4.4 per cent of the Egyptians and 13.8 per cent of the English scored one mark by mentioning correctly either of the two gases, while 8.9 per cent of the Egyptians and 20.7 per cent of the English failed to score (Figure 7.8).

In the question 'Mice', nearly half of the Egyptians succeeded in their predictions in terms of hereditary material making reference to either genes or chromosomes, and successfully distinguished between inherited and non-inherited characteristics. Just over a third of the English children showed the same understanding. About a fifth of both Egyptian and English children gave correct answers for the two parts of the question in terms of general explanations, while about a further fifth gave the same general explanations for one part only and failed to answer the other part. None of the Egyptians and over a quarter of the English failed to distinguish with varying degrees between inherited and non-inherited characteristics, though 8.9 per cent of the Egyptians made no attempt to answer. Table 7.12 shows the distribution of scores obtained.

Nearly a third of each Egyptian and English children showed their understanding of the differences in variation produced by sexual as opposed to asexual reproduction involved in the question 'Spider Plant'. Thirty-one per

FIG. 7.8



cent of the Egyptians and 34.5 per cent of the English selected the correct response. For the Egyptian subjects, the mean score was 0.31 (with S.D. 0.47, S.E. .05) and for the English the mean score was 0.35 (with S.D. = 0.48, S.E. = 0.06).

Table (7.12)
Egyptian and English Children's Responses to "Mice"
in number and percentage

Sub. _____		Scores										\bar{X}	S.D	S.E
		0		1		2		3		P				
Loc.		No.	%	No.	%	No.	%	No.	%	No.	%			
Eg	- -	20	22.2	19	21.1	43	47.8	8	8.9	2.08	1.03	0.11		
En	15 25.9	11 19		11 19		20 34.5		1 1.7		1.60	1.23	0.16		

For the question 'Ivy', 10.0 per cent of the Egyptians and 15.5 per cent of the English predicted two acceptable hypotheses and gave scientific and logical explanations for the two parts of the question. Nearly 29.0 per cent of the Egyptians and 21.0 per cent of the English predicted two acceptable hypotheses but succeeded to give only one acceptable explanation for either hypothesis. About a third of each group managed to answer one full part correctly or to give two acceptable reasons without explanation. A further 11.1 per cent of the Egyptians and

17.2 per cent of the English scored one mark by giving only one acceptable hypothesis without explanation. Only 3.3 per cent of Egyptians and 12.1 per cent of the English failed to score (Table 7.13).

Table (7.13)
Egyptian and English Children's Responses to "Ivy"
in percentage

Sub. Loc.	Scores						\bar{X}	S.D	S.E
	0	1	2	3	4	P			
Eg	3.3	11.1	24.4	28.9	10	22.2	1.87	1.35	0.14
En	12.1	17.2	32.8	20.7	15.5	1.7	2.07	1.26	0.17

In the question 'Menstrual Cycle', 28.9 per cent of Egyptian children selected the correct response, with mean score = 0.29 and S.D. = 0.46, S.E. = .05. For the English children the percentage of correct answer was 25.9, with mean score = 0.26 and S.D. = 0.44, S.E. = 0.06.

As regards the question 'Animal Eggs', only 2.2 per cent of the Egyptians and 1.7 per cent of the English obtained maximum score through mentioning the maintenance of a stable population besides ^{the} other four acceptable reasons. 7.8 per cent of the Egyptians and 15.5 of the

English succeeded in inferring four acceptable reasons from the information given. Figure 7.9 demonstrates the percentage of children's responses according to the hypotheses they made.

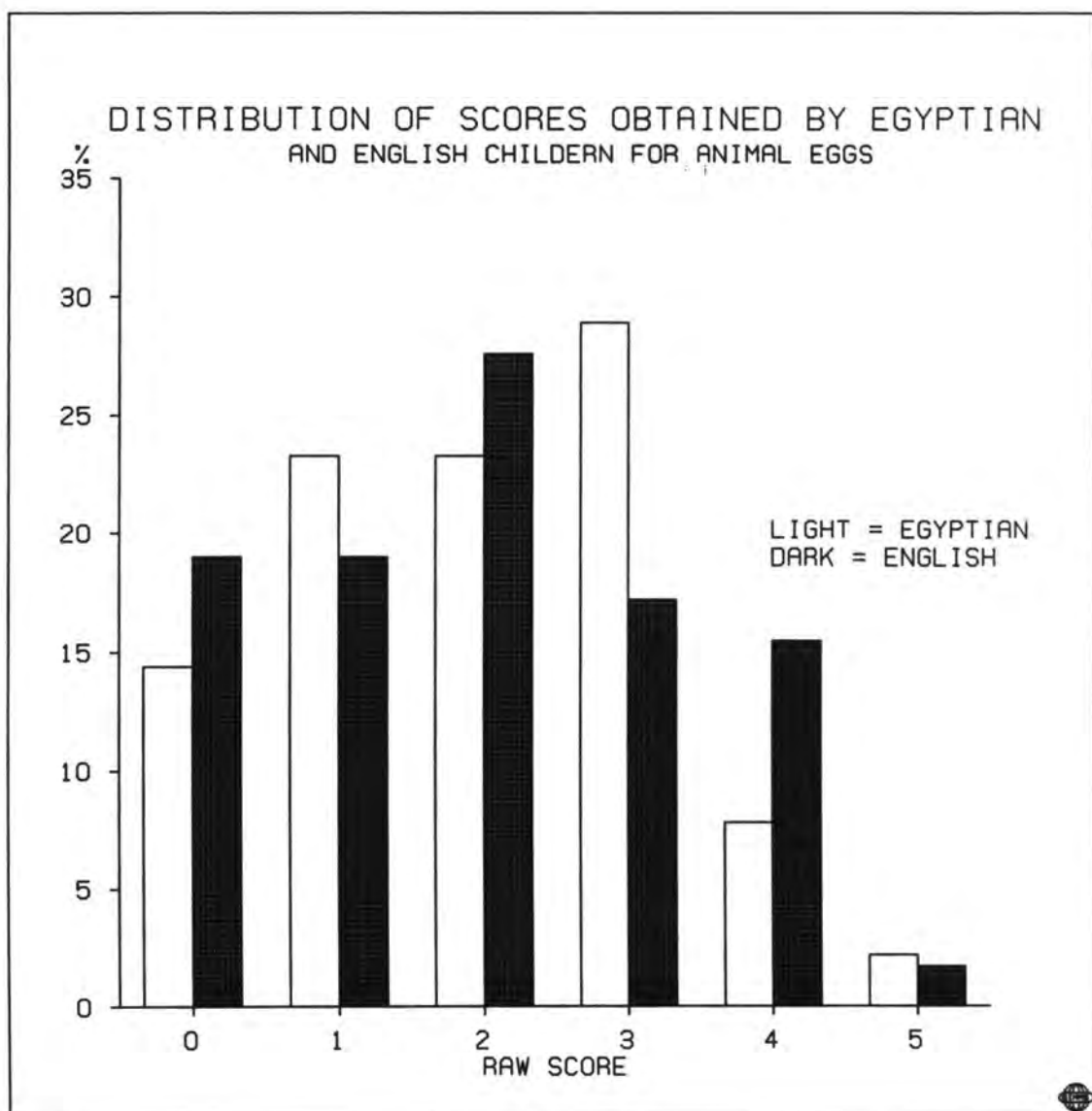
In the question 'Sexual Reproduction', more than 40 per cent of the children of both countries showed their understanding that sexual reproduction is associated with animals as well as with plants, though this was demonstrated in varying degrees; 23.3 per cent of the Egyptians and 15.5 of the English obtained maximum score in their selection of correct answers, while 22.2 per cent of the Egyptians and 27.6 per cent of the English selected three correct instances. The responses obtained revealed also that more than a quarter of the children attributed sexual reproduction to animals rather than to plants. Table 7.14 shows the percentage of the children's responses.

Table (7.14)

Egyptian and English Children's Responses to "Sexual Reproduction" in percentage

Sub. Loc.	Scores						\bar{X}	S.D	S.E
	0	1	2	3	4	P			
Eg	4.4	11.1	38.9	22.2	23.3	-	2.49	1.10	0.12
En	15.5	12.1	29.3	27.6	15.5	-	2.16	1.28	0.17

FIG. 7.9



7.2.2 Chemical Concepts

Egyptian and English children showed approximately the same pattern of responses to the question 'Reaction Rate'. Slightly more than a quarter of the two samples (30 per cent Egyptians, 27.6 per cent English) chose the correct graph indicating their understanding of the concept that the rate of the reaction changes but not the volume of the product. Just over forty-two per cent of the Egyptians and 51.7 per cent of the English thought that an increase in temperature would result in an increase in volume of product. The rest of all children selected one of the other two incorrect graphs, and only one English child gave no answer. For the Egyptians the mean score was 0.30 (with S.D. = 0.46 and S.E. = 0.05), and for the English the mean score was 0.28 (with S.D. = 0.45 and S.E. = 0.06).

In the question 'Sodium' 42.2 per cent of the Egyptians and 39.7 per cent of the English predicted correctly a positive sodium ion was produced when an electron was removed from a sodium atom. Almost equally over a quarter of Egyptian and English children incorrectly thought that sodium would change to another element, and the rest chose a wrong change on the condition. Of the Egyptians 7.8 per cent failed to give any answer. For the Egyptians the mean score was 0.42 (with S.D. = 0.50 and S.E. = 0.05), and for the English the mean score was 0.40 (with S.D. = 0.49 and S.E. = 0.07).

As the results of the question 'Phosphorus' indicate, 33.3 per cent of the Egyptians 51.7 per cent of the English succeeded in predicting that the mass of the contents of the flask would remain the same before and after the reaction. But only 26.6 per cent of the Egyptians and 44.8 per cent of the English managed to give relevantly scientific explanations for their answers, though in varying degrees. Table 7.15 shows the scores of the children's responses as a whole.

Table (7.15)
Egyptian and English Children's Responses to "Phosphorus"
in number and percentage

Sub. _____		Scores												
		0		1		2		3		P				
Loc.	0		1		2		3		P		\bar{X}	S.D	S.E	
	<u> </u>		<u> </u>		<u> </u>		<u> </u>		<u> </u>					
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	60	66.7	6	6.7	13	14.4	11	12.2	-	-	0.72	1.11	0.11	
En	27	46.6	4	6.9	16	27.6	10	17.2	1	1.7	1.14	1.21	0.16	

The performance of the children of both locations in the question 'Nail' was higher than that demonstrated in question 'Phosphorus'. Over 80.0 per cent of the Egyptians, and about 70.0 per cent of the English chose the correct answer indicating the point at which the nail would rust most. Sixty-one per cent of the English and

46.5 per cent of the Egyptians succeeded in predicting that both air and water were necessary for rusting to take place. But 23.3 per cent of the Egyptians and 17.2 per cent of the English mentioned that the maximum meeting of air and water would be at the surface (Table 7.16).

Table (7.16)
Egyptian and English Children's Responses to "Nail"
in number and percentage

Sub.		Scores										\bar{X} S.D S.E		
		0		1		2		3		P				
Loc.	0		1		2		3		P					
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	16	17.8	19	21.1	34	37.8	21	23.3	-	-	1.67	1.03	0.11	
En	17	29.3	14	24.1	17	29.3	10	17.2	-	-	1.35	1.09	0.14	

In the question 'PH Graph' Egyptian and English children showed the same pattern of responses. The percentage of 55.6 of the Egyptians and 50 of the English chose the correct answer that reflected their chemical knowledge of classifying the two liquids involved. The rest of the children except 4.4 per cent of the Egyptians who gave no answer, selected responses that indicated their understanding of the structure of one of the two liquids separately. For the Egyptians the mean score was 0.56 (with S.D. = 0.50 and S.E. = 0.05), and for the

English the mean score was 0.50 (with S.D. = 0.50 and S.E. = 0.07).

A lower percentage of correct responses was obtained on the question 'Copper Pipes' than that on the question 'Nail' though both were assessing the concept of properties of chemical reactions as regards the reaction of air with an element. About a third of the children of both locations recognized correctly the reaction between copper and oxygen from the air was the reason for the black coating on the copper pipes. Nearly 10.0 per cent of the children stated correctly that copper oxide was the substance of which the tarnish was made. Only about a fifth of the children succeeded in appreciating that heat increased the rate of reaction, and 5.6 per cent of the Egyptians and a higher percentage of 15.5 of the English gave no answer (Table 7.17).

Table (7.17)

Egyptian and English Children's Responses to "Copper Pipes" in number and percentage

Sub. _____		Scores _____										\bar{X}	S.D	S.E
		0		1		2		3		P				
Loc.		No.	%	No.	%	No.	%	No.	%	No.	%			
Eg	36 40	29	32.2	12	13.3	8	8.9	5	5.6	0.86	0.97	0.10		
En	20 34.5	14	24.1	9	15.5	6	10.3	9	15.5	0.86	1.03	0.14		

7.2.3 Physics Concepts

There was a quite noticeable variation in the children's performance on the two parts of the question 'Watering Can', though the two parts were to assess the children's idea that water tends to flow until the surface reaches a common level. About half the Egyptians and two thirds of the English performed correctly on part a of the question by drawing a horizontal line at correct level in the spout. In part b about a fifth of the Egyptians and one third of the English drew only one correct horizontal line in either can or spout. Less than 12 per cent of the Egyptians and nearly 20 per cent of the English succeeded in drawing the two correct horizontal lines in part b, despite the failure of some of them in part a. Table 7.18 shows the percentage of the children's scores obtained on the question as a whole.

Table (7.18)

Egyptian and English Children's Responses to "Watering Can" in number and percentage

Sub. _____		Scores										\bar{X}	S.D	S.E
		0		1		2		3		P				
Loc.	0		1		2		3		P					
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	30	33.3	34	37.8	17	18.9	6	6.7	3	3.3	0.96	0.91	0.10	
En	11	19	17	29.3	17	29.3	9	15.5	4	6.9	1.35	1.04	0.14	

In the question 'Energy Transfer', the children of both locations demonstrated equally the highest level of performance in this groups of physics questions. Correct responses to all five parts of the questions were 43.3 per cent for the Egyptians and 44.8 for the English. While a third of the Egyptians and over a fifth of the English succeeded in selecting four out of five instances in which energy was being either transferred or not, confusing only about one instance. The mean score was high compared to other questions. It was 4.01 (80%) for the Egyptians, and 3.69 (74%) for the English with 8.6 per cent of English children not responding. Full results are shown in Figure 7.10.

For the question 'Kettle and Bath', the results indicated a quite different pattern of response taken by the children from that performed in the question 'Energy Transfer'. Although over 95.0 per cent of the children selected the correct option that the water in the bath would cost more to heat than the water in the kettle, about a quarter of them failed to give reasonably accepted justifications. None of the Egyptians and only one English child obtained maximum score. About half the Egyptians and a fifth of the English considered only the factor of the greater volume of water in the bath, and 7.0 per cent of the Egyptians and 2.0 per cent of the English mentioned the factor of raising a greater temperature for kettle water. A further 9.0 per cent of the Egyptians and

FIG. 7.10

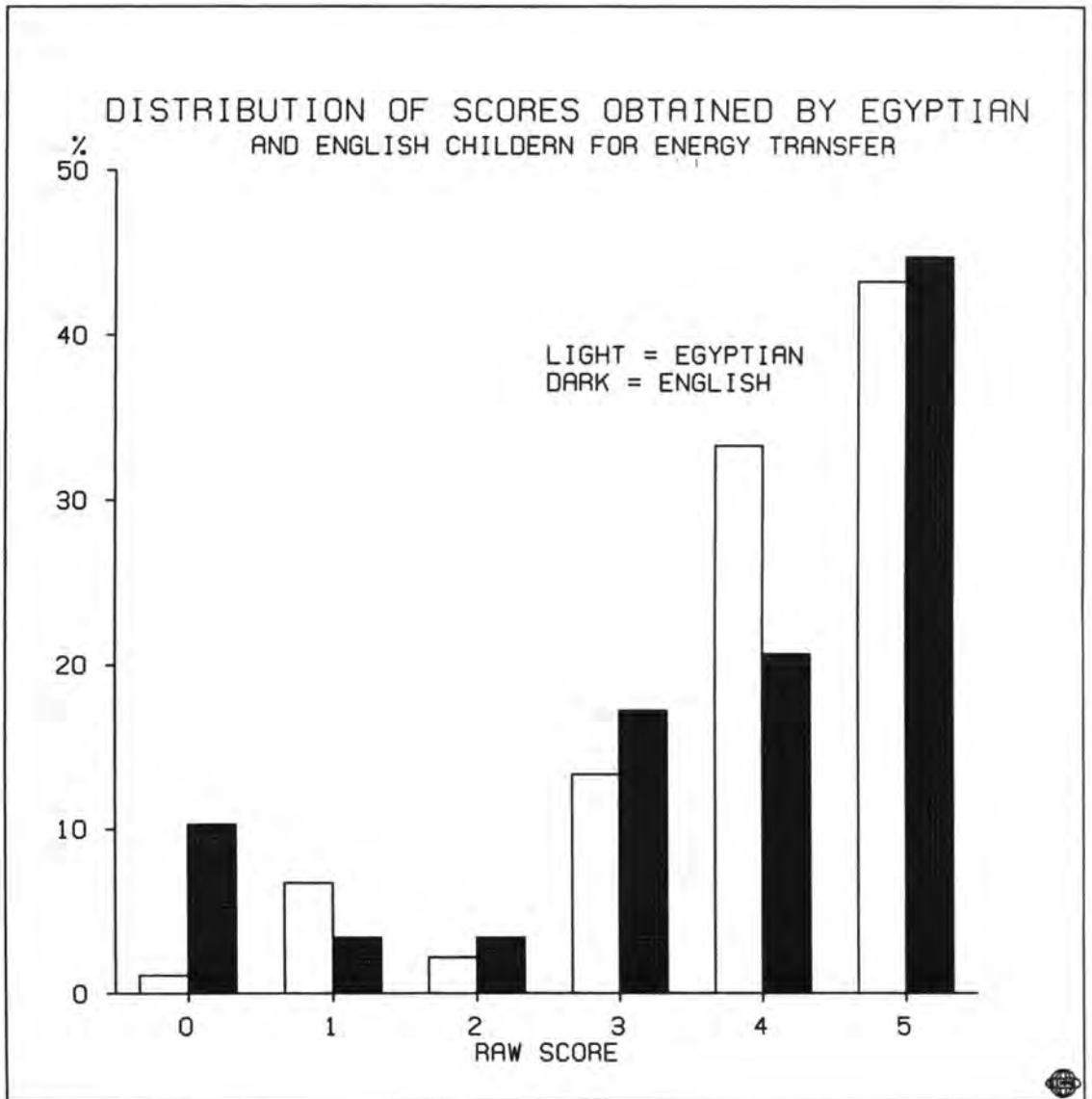
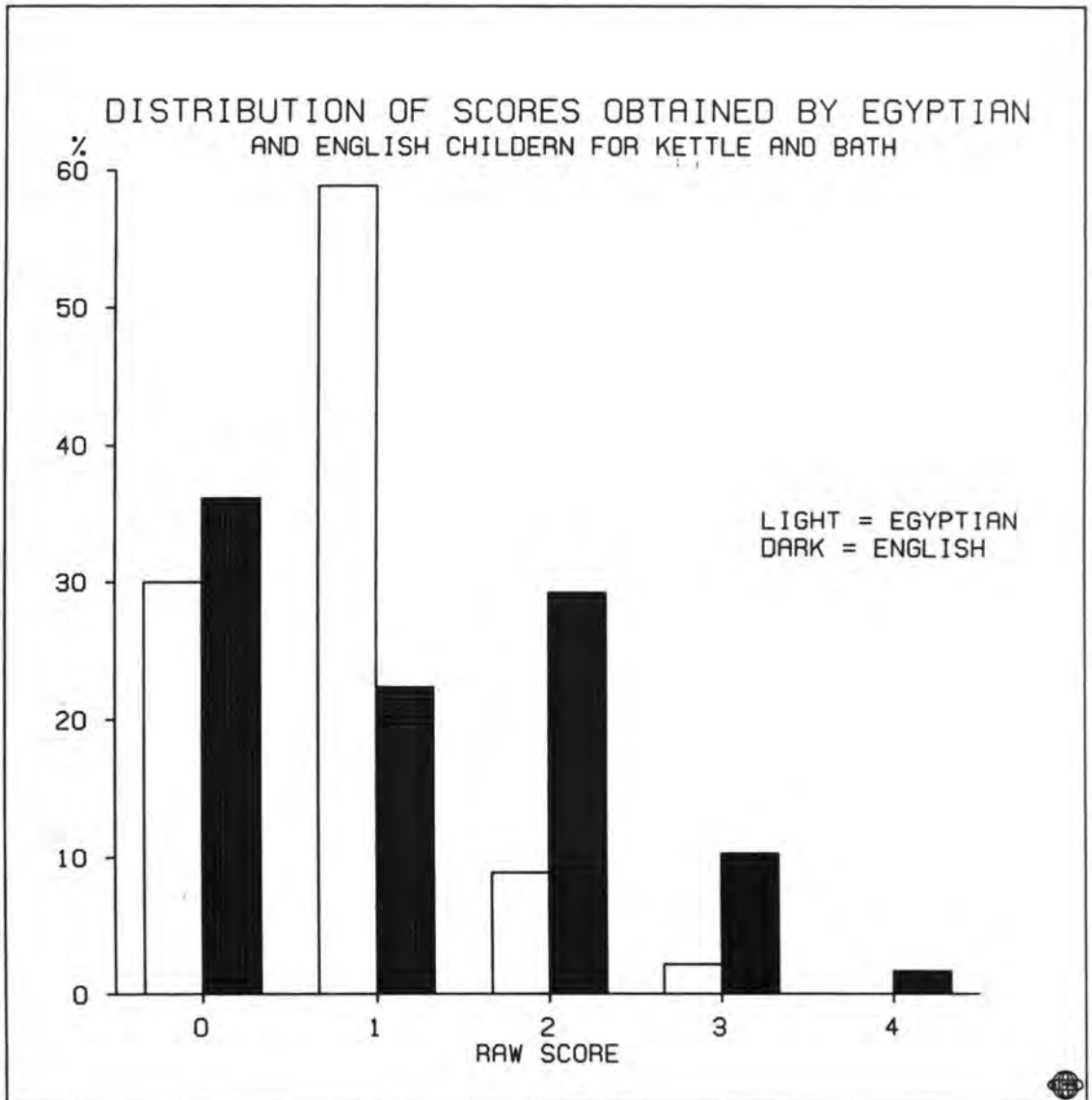


FIG. 7.11



about 30 per cent of the English mentioned the two factors without relating them to each other. About 2.0 per cent of the Egyptians and 10.0 per cent of the English succeeded in relating the two factors in general terms(Figure 7.11).

Like the question 'Kettle and Bath', the level of children's performance was very low in the question 'Tables' compared to their performance in the question 'Energy Transfer'. None of the children of both locations was able to obtain maximum score. About a fifth of the Egyptians and a third of the English chose the correct answer in part a without giving reasons, so they were given no marks. Exactly a third of the Egyptians and 10.3 per cent of the English considered only one of the two variables involved (e.g. the weight of the table and the area in contact), while 11.1 per cent of the Egyptians and 20.7 of the English took account for the two factors without relating them with each other. Only 13.3 per cent of the Egyptians and 10.3 of the English managed to calculate the two factors, but jumped to conclusions without comparison. Table 7.19 shows the distributions of marks obtained by the children of both locations.

In the question 'Car Tyre', the pattern of the children's response was slightly higher than that maintained in the question 'Table' though both questions involved the idea of pressure. More than a third of the Egyptians and about a fifth of the English responded irrelevantly or repeated literally some parts of the

Table (7.19)

Egyptian and English Children's Responses to "Tables"
in percentage

Sub. Loc.	Scores						\bar{X}	S.D	S.E
	0	1	2	3	4	P			
Eg	37.8	33.3	11.1	13.3	-	4.4	0.96	1.04	0.11
En	58.6	10.3	20.7	10.3	-	-	0.83	1.09	0.14

question. Another fifth of the Egyptians and more than a third of the English made reference only to particles in their reasoning. A further 16.7 per cent of the Egyptians and 12.1 per cent of the English considered both heat and particles in their explanations but did not mention the increasing bombardment on the wall of the tyre, while this was referred to, with heat and particles, by 16.7 per cent of the Egyptians and 22.4 per cent of the English. The no response rate in this question was 6.7 per cent of the Egyptians and 8.6 per cent of the English. (see Table 7.20).

In the question 'Drop Sand' which involved the idea of gravitational potential energy, the pattern of the children's response in part a differed from that performed

Table (7.20)
Egyptian and English Children's Responses to "Car Tyre"
in number and percentage

Sub.		Scores										\bar{X}	S.D	S.E
		0		1		2		3		P				
Loc.														
	No.	%	No.	%	No.	%	No.	%	No.	%				
Eg	35	38.9	19	21.1	15	16.7	15	16.7	6	6.7	1.04	1.14	0.12	
En	11	19	22	37.9	7	12.1	13	22.4	5	8.6	1.29	1.11	0.15	

in part b, although the correct answer in the two parts required the idea that the kinetic energy which a falling object can gain depends on the product of its mass and the height from which it is dropped. In part a, 33.3 per cent of the Egyptians and only 15.5 per cent of the English selected the correct answer. While in part b, the situation was completely reversed; only 15.6 per cent of the Egyptians and 39.7 per cent of the English chose the correct answer. For the Egyptians only 11.1 per cent gave the correct answer to both parts of the question, and 51.1 per cent failed to select the right answer in both parts, and the mean score was 0.60 (30%) with S.D. = 0.68, S.E. = 0.07. As for the English children 36.2 per cent succeeded in selecting the correct response to both parts, 32.8 per cent selected wrong answers to both parts, and 12.1 per

cent gave no response; the mean score was 0.91 (45.5%) with S.D. = 0.90 and S.E. = 0.12.

The performance of Egyptian and English children on the question 'Man' which involved the concept of movement and deformation was nearly similar. A percentage of 63.3 of the Egyptians chose the correct answer as compared to 65.5 per cent of the English. Whereas 36.7 per cent of the Egyptians and 19.0 per cent of the English opted for wrong responses, and 15.5 per cent of the English gave no response. The mean score for the Egyptians was 0.63 (63%) with S.D. = 0.49, S.E. = 0.05. For the English the mean score was 0.66 (66%) with S.D. = 0.48, S.E. = 0.06.

The question 'Current Electricity' was the only one in this group of physics questions that assessed the children's understanding of the relation between resistance and current in two different situations. In part a the performance of the children was slightly higher. Nearly half of the Egyptians and over a third of the English predicted the correct reading of the ammeter with different range of explanation. In part b it was over a third of the Egyptians and a fifth of the English that succeeded in predicting the correct reading of the ammeter, with also varying degrees of explanations. Degrees of explanation were ranging from referring only to the current in part a and/or part b, to both current and resistance without calculating their reversible relation, to calculating this relation in part a and/or part b.

None of the children obtained maximum score, though 4.4 per cent of the Egyptians and 1.7 per cent of the English showed their full understanding of the concept but did not take care of the calculation in either of the two parts. Exactly 40.0 per cent of the Egyptians and 50.0 per cent of the English failed to respond correctly to any of the two parts. For the Egyptians the mean score was 2.46 (30.8%) with S.D. = 2.32, S.E. = 0.24, while for the English the mean score was 1.57 (19.6%) with S.D. = 2.02, S.E. = 0.27. Distributions of scores are shown in Figure 7.12.

The level of performance on the question 'Plank' was very low for both Egyptian and English children, though the Egyptians performed slightly higher. Two third of the Egyptians and over 90.0 per cent of the English failed to select the right response to part a. A third of the Egyptians and less than 10.0 per cent of the English selected the correct answer to this part, but only a fifth of the Egyptians and 5.0 per cent of the English succeeded in giving reasons with varying degrees of understanding. For the Egyptians the mean score was 0.61 (20.3%) with S.D. = 0.92, S.E. = 0.10, and for the English the mean score was 0.17 (5.7%) with S.D. = 0.63, S.E. = 0.08. Table 7.21 shows the distributions of children's scores.

FIG. 7.12

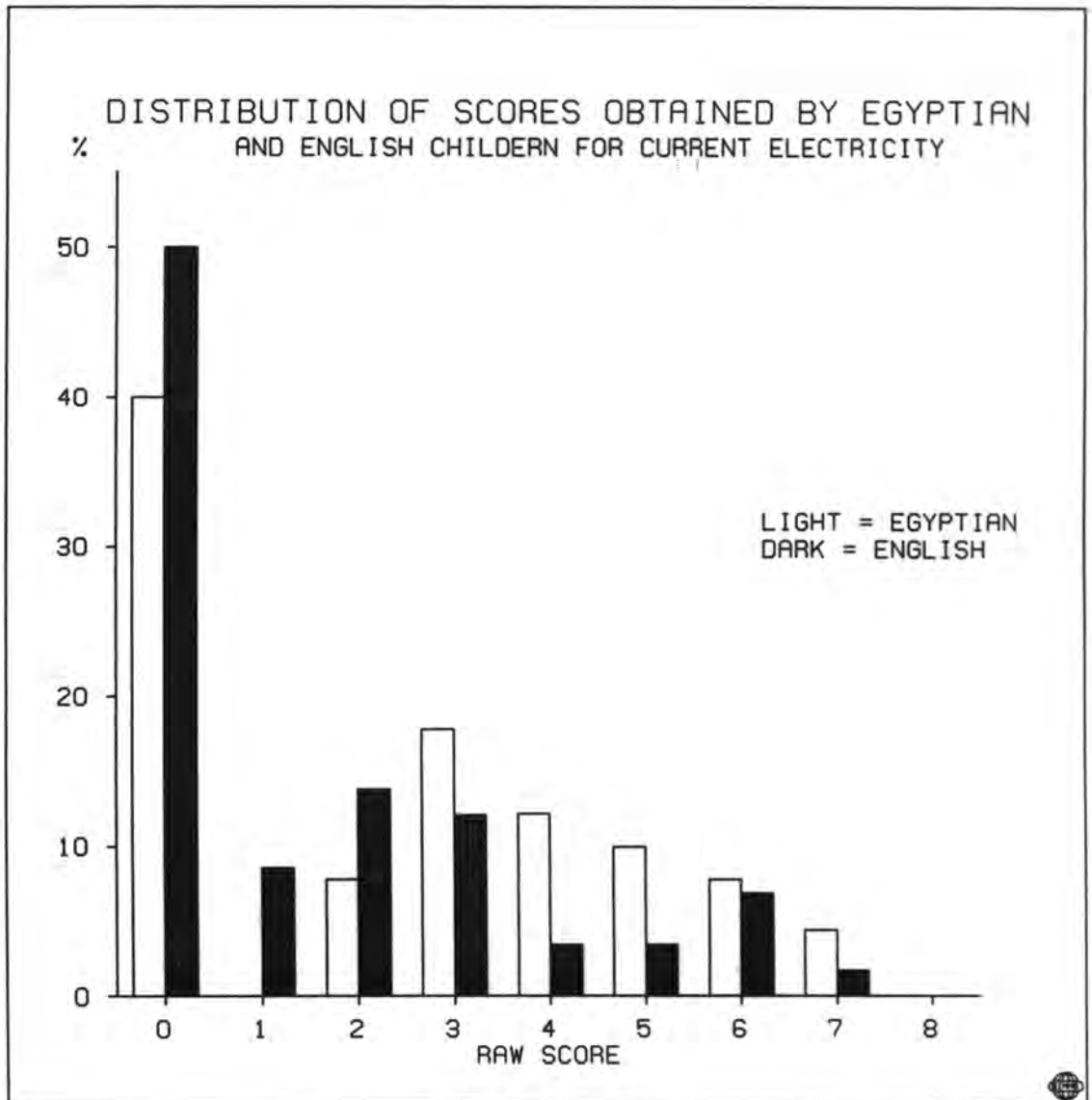


Table (7.21)
Egyptian and English Children's Responses to "Plank"
in number and percentage

Sub. -	Scores										\bar{X}	S.D	S.E
	0		1		2		3		P				
Loc.	No. %		No. %		No. %		No. %		No. %				
Eg	58	64.4	13	14.4	15	16.7	4	4.4	-	-	0.61	0.92	0.10
En	44	75.9	2	3.4	1	1.7	2	3.4	9	15.5	0.71	0.63	0.08

7.3 COMPARATIVE ANALYSIS OF THE DATA

In an examination of the overall sum of the mean scores (in percentage) there were differences between the scores of the 11 year old children and the children of 13 and 15 years who had very similar scores. The 13 year old children scored very slightly better than the 15 year olds, but this probably an artefact of the differences in the test problems set to the two age groups of 13 and 15. The overall mean performance levels expressed as percentages can be seen in table 7.22.

Table 7.22

Overall Mean Performance Levels On the Three
Science Branches Tested in Percentage

Age	Loc.	Biology	Chemistry	Physics	Mean
11	Eg	40.3	34.2	24.1	32.9
	En	35.7	31.6	28.2	31.8
13	Eg	44.6	47.1	36.0	42.8
	En	43.2	38.9	38.4	40.2
15	Eg	44.5	39.4	37.3	40.5
	En	40.3	38.3	38.8	39.3

Further examination of the last column in table 7.22 shows the great similarity in the results of the Egyptian and English children when the results are considered overall. But an examination of the nine questions (Grasshopper, Ivy, Gas balance, Nail, Phosphorus, Watering can, Car ^rtye, Kettle and bath, and Man) set for the purpose of comparing the children of the two cultures confirmed the improved scores of the children at age 13 over the children of 11 years as shown in table 7.23 but it also showed an improvement of the scores at age 15 over the 13 year olds as was indeed expected but was missing in the results tabled in 7.22.

Table 7.23

Overall Mean Score for the Nine Questions
Set for Comparison in Percentage

Age	Loc.	Biology	Chemistry	Physics	Mean
11	Eg	33.3	21.0	22.1	25.6
	En	27.6	19.7	25.2	24.8
13	Eg	43.7	31.5	34.1	36.7
	En	37.3	24.0	38.8	35.0
15	Eg	46.5	39.8	37.6	41.1
	En	42.4	41.5	45.9	43.8

When the Mann-Whitney U test was applied to the data from all the results of all the tests, differences which had been obscured in the overall means were demonstrated between the two cultures. There were significant differences between the Egyptians and the English in their performance in 16 out of 37 questions at age 11. Statistically significant differences were in favour of the Egyptian children on 12 questions, while the English were superior in 4 questions (Table 7.24).

At age 13 the significant differences were demonstrated in 15 questions; 10 in favour of the Egyptians and 5 in favour of the English (Table 7.25).

Table (7.24)

Significant Differences between Egyptian and English
Children of Age 11 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Life Cycle	Eg	78.08	0.0001
	En	97.58	
Snow in Fields	Eg	98.53	0.0001
	En	70.49	
Gas Balance	Eg	92.26	0.002
	En	69.91	
Goosegrass	Eg	97.64	0.002
	En	76.11	
Grasshoppers	Eg	95.09	0.0003
	En	70.80	
Beak Shapes	Eg	95.46	0.03
	En	79.54	
Stream	Eg	100.34	0.000
	En	52.02	
Tree Section	Eg	109.61	0.000
	En	54.17	
Heating Elements	Eg	82.03	0.03
	En	67.68	
Coal and Oil	Eg	69.97	0.0001
	En	97.54	
Reactivity	Eg	60.37	0.000
	En	33.91	
Acid and Alkali	Eg	99.50	0.001
	En	77.50	
Freezing	Eg	92.12	0.03
	En	77.57	
Kettle and Bath	Eg	75.14	0.0001
	En	100.44	
Source of Energy	Eg	75.62	0.0001
	En	98.51	
Torch	Eg	95.09	0.0001
	En	72.45	

Table (7.25)

Significant Differences between Egyptian and English
Children of Age 13 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Life Cycle	Eg	80.39	0.0002
	En	94.00	
Fish Tank	Eg	69.66	0.007
	En	88.62	
Snow in Fields	Eg	90.67	0.005
	En	70.82	
Grasshoppers	Eg	105.18	0.000
	En	63.33	
Beak Shapes	Eg	94.59	0.009
	En	76.20	
Stream	Eg	86.61	0.001
	En	62.58	
Tree Section	Eg	96.22	0.0005
	En	71.63	
Melting Ice	Eg	95.34	0.005
	En	76.33	
Reactivity	Eg	93.99	0.000
	En	55.75	
Acid and Alkali	Eg	92.09	0.03
	En	77.65	
Freezing	Eg	76.66	0.002
	En	96.81	
Watering Can	Eg	79.38	0.03
	En	95.07	
Electro-magnet	Eg	91.48	0.0001
	En	63.74	
Source of Energy	Eg	76.19	0.001
	En	99.52	
Torch	Eg	92.35	0.03
	En	77.01	

At age 15 the significant differences were revealed the performance of the children on 9 out of the 25 questions; 5 in favour of Egyptian subjects and 4 in favour of English subjects (Table 7.26).

Table (7.26)
Significant Differences between Egyptian and English
Children of Age 15 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Gas Balance	Eg	79.35	0.04
	En	64.63	
Onion Plant	Eg	65.14	0.01
	En	50.33	
Mice	Eg	78.45	0.002
	En	57.85	
Grasshoppers	Eg	77.09	0.02
	En	61.75	
Phosphorus	Eg	68.42	0.02
	En	82.81	
Watering Can	Eg	64.06	0.01
	En	82.18	
Kettle and Bath	Eg	62.91	0.01
	En	78.95	
Drop Sand	Eg	64.11	0.004
	En	83.16	
Plank	Eg	76.06	0.002
	En	58.87	

For the differences between the performance of the children of age 11 and that of age 13 Mann-Whitney U test revealed significant variations. Table 7.27 shows that these differences occurred among the Egyptians in 19

questions (5 biological, 6 chemical, and 8 physical). Table 7.28 illustrates that these differences occurred among the English in 17 questions (5 biological, 6 chemical, and 6 physical).

Table (7.27)

Significant Differences between Egyptian Children of Ages 11 and 13 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Life Cycle	11	84.00	0.02
	13	97.00	
Snow in Fields	11	82.48	0.03
	13	98.52	
Ivy	11	83.12	0.05
	13	97.88	
Grasshoppers	11	71.81	0.000
	13	109.19	
Tree Section	11	103.44	0.001
	13	77.56	
Melting Ice	11	78.06	0.000
	13	102.94	
Heating Elements	11	82.88	0.04
	13	98.12	
Nail	11	78.20	0.001
	13	102.80	
Coal and Oil	11	74.41	0.000
	13	106.59	
Solution	11	65.56	0.000
	13	115.44	
Reactivity	11	69.51	0.000
	13	111.49	
Freezing	11	98.87	0.01
	13	82.13	
Car Tyre	11	76.56	0.0001
	13	104.37	
Kettle and Bath	11	77.14	0.05
	13	103.86	
Man	11	82.50	0.000
	13	98.50	
See-Saw	11	80.50	0.002
	13	100.50	
Electro-Magnet	11	69.97	0.000
	13	111.03	
Torch	11	73.01	0.000
	13	107.99	
Boiling Potatoes	11	73.12	0.000
	13	107.88	

Table (7.28)
Significant Differences between English Children
of Ages 11 and 13 (Mann-Whitney U-Test)

Question	Loc .	Mean Rank	P
Life Cycle	11	84.70	0.016
	13	90.50	
Fish Tank	11	78.51	0.01
	13	97.13	
Snow in fields	11	77.86	0.006
	13	97.83	
Ivy	11	75.50	0.001
	13	100.36	
Goosegrass	11	76.99	0.002
	13	98.76	
Stream	11	79.99	0.0001
	13	95.54	
Melting Ice	11	79.34	0.01
	13	96.24	
Heating Elements	11	79.56	0.02
	13	96.01	
Solution	11	77.16	0.003
	13	98.58	
Reactivity	11	82.93	0.003
	13	92.40	
Acid and Alkali	11	80.70	0.03
	13	94.79	
Freezing	11	79.78	0.02
	13	95.77	
Car Tyre	11	73.37	0.000
	13	102.64	
Watering Can	11	75.49	0.001
	13	100.37	
Man	11	81.40	0.05
	13	94.04	
Torch	11	70.84	0.000
	13	105.35	
Boiling Potatoes	11	79.71	0.008
	13	95.85	

7.3.2 Differences between Boys and Girls

At age 11 the Mann-Whitney U test did not indicate any significant differences between Egyptian boys and girls, while there were significant variations in the performance between English boys and girls in seven questions. Table 7.29 shows that the superiority of English girls over boys were demonstrated in four questions, while boys performed significantly higher in three questions.

Table (7.29)
Significant Differences between English Boys
and Girls at Age 11 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Snail	Boys	39.52	0.02
	Girls	50.97	
Food Chain	Boys	39.61	0.01
	Girls	49.82	
Senses	Boys	34.52	0.0004
	Girls	52.06	
Melting Ice	Boys	50.54	0.04
	Girls	40.05	
Heating Elements	Boys	30.77	0.007
	Girls	43.40	
Watering Can	Boys	47.87	0.05
	Girls	38.24	
Man	Boys	44.52	0.009
	Girls	37.75	

At age 13 Egyptian boys performed significantly better than girls on eleven questions, while girls were superior to boys in only one question as shown in table 7.30.

Table (7.30)
Significant Differences between Egyptian Boys
and Girls at Age 13 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Fish Tank	Boys	42.76	0.05
	Girls	33.24	
Snow in Fields	Boys	45.10	0.01
	Girls	32.61	
Ivy	Boys	43.23	0.000
	Girls	24.08	
Food Web	Boys	50.09	0.000
	Girls	26.34	
Field of Grass	Boys	34.78	0.004
	Girls	48.78	
Melting Ice	Boys	48.53	0.04
	Girls	38.16	
Phosphorus	Boys	49.50	0.05
	Girls	40.50	
Freezing	Boys	49.96	0.003
	Girls	37.95	
Watering Can	Boys	51.52	0.004
	Girls	37.01	
Electro-magnet	Boys	47.95	0.02
	Girls	35.23	
Torch	Boys	51.42	0.001
	Girls	35.81	
Salty Water	Boys	48.09	0.04
	Girls	37.70	

Significant differences between English boys and girls of age 13 were manifested only in three questions: 'Grasshoppers' in which girls performed significantly higher ($p = 0.001$) while, boys demonstrated a higher performance in 'Man' ($p = 0.01$) and in 'Torch' ($p = 0.01$).

At age 15 significant differences between Egyptian boys and girls were demonstrated in six questions all of which were in favour of boys (Table 7.31). The English boys performed significantly lower than girls on three biological questions: 'Food Web' ($p = 0.01$), 'Animal eggs' ($p = 0.002$) and 'Spider Plant' ($p = 0.03$).

Table (7.31)
Significant Differences between Egyptian Boys
and Girls at Age 15 (Mann-Whitney U-Test)

Question	Loc.	Mean Rank	P
Onion Plant	Boys	37.79	0.001
	Girls	23.07	
Grasshoppers	Boys	47.94	0.02
	Girls	36.28	
Ivy	Boys	40.66	0.003
	Girls	26.22	
Phosphorus	Boys	50.74	0.01
	Girls	38.95	
Watering Can	Boys	54.91	0.000
	Girls	31.17	
Energy Transfer	Boys	51.19	0.01
	Girls	38.39	

7.4 IMPLICATIONS OF THE DATA FOR DEVELOPMENTAL STAGES

When classified according to the Piagetian developmental stages, the results obtained from the thirty seven questions tested at age 11 and 13 revealed no differences between the Egyptian 11 -year- olds and 13 -year- olds as regards the attainment of the late formal stage. But there was a slight difference in the attainment of this level between the English children of the two age groups. Table 7.32 contains the mean performance of the Egyptian and English children of ages 11 and 13 who succeeded in getting items at each development level correct.

Table (7.32)

Mean Percentage of Success of 11 and 13 Age Groups
in the Whole Test for Each Developmental Level

Age	Loc.	Developmental Stages							
		1/2A	2A	2A/2B	2B	2B/3A	3A	3A/3B	3B
11	Eg	3.3	59.8	25.7	34.4	22.2	25.5	26.5	27.8
13		2.8	69.6	24.2	45.0	20.1	42.1	21.0	28.9
11	En	4.5	59.1	20.3	31.9	20.9	29.8	20.4	13.9
13		2.8	68.4	22.3	41.4	19.0	44.5	22.0	20.5

At age 15 the classification of the results of the twenty five questions of the test showed a very slight difference between the children of the two cultures

concerning the attainment of all stages and sub-stages. Table 7.33 shows the distribution of the children of age 15 who succeeded at each level. It also shows, compared to table 7.32, the increasing percentage of the children who successfully attained the late formal stage, though the comparison is not conclusive since not all the items tested were shared.

Table (7.33)
Mean Percentage of Success of 15-Year-Olds in the
Whole Test for Each Developmental Level

Loc.	Developmental Stages					
	2A/2B	2B	2B/3A	3A	3A/3B	3B
Eg	18.7	48.9	14.4	43.7	17.2	41.1
En	17.9	43.1	15.5	43.3	12.1	39.3

In the nine questions set for the purpose of comparison between age groups on the one hand and the two cultures on the other, there was clearly less change in the performance of the Egyptian children of the ages 11 and 15 as compared to their performance on the whole tests. The Egyptian children of age 13 and the English children of the three age groups demonstrated a level of performance very similar to the overall performance they achieved on the whole tests. Table 7.34 illustrates the comparison of the children's success in the attainment of each developmental stage for the nine questions set for this purpose.

Table (7.34)
Mean Percentage of Success of All Children in the
Nine Questions for Each Developmental Level

Age	Loc.	Developmental Stages					
		2A/2B	2B	2B/3A	3A	3A/3B	3B
11		24.5	24.8	31.1	23.3	30.4	18.9
13	Eg	20.4	48.9	29.6	37.0	27.4	26.7
15		-	63.3	23.3	40.8	28.5	34.0
11		21.5	24.1	28.5	26.3	30.0	14.8
13	En	17.4	36.5	29.4	48.0	28.6	21.0
15		-	65.5	28.1	49.4	16.7	43.6

7.5 DISCUSSION OF THE DATA

The correlations between the scores obtained on the tests of this study when the two samples were amalgamated and the estimated profiles of scores on the same tests in the reports of Assessment of Performance Unit have tended to be similar. The analyses of the scores in terms of stages of developmental thinking provided clear evidence that Piagetian levels of intellectual development were manifested in the performance of the Egyptian and English children on science concepts tested in this study. As it was hypothesized, the children participating in these science tests demonstrated concrete and formal stages and substages in correlation with age levels (Tables 7.32, 7.33, and 7.34).

Though this finding corroborated the first hypothesis, it did not give a clear cut answer to the question whether clear evidence for specific ages at which children progress from one stage of development to another could be determined. The overall data indicated that children moved towards formal operational thinking with the increasing age. Yet, only 40 per cent of the 15-year-old subjects managed to demonstrate late formal operational thinking. More to the point, younger children demonstrated a higher performance of late formal operational stage than older children on some of the concepts tested. The same proportion of all children attained the late concrete operational stage.

These observations tend to run counter to the Piagetian suggestion of a specific age at which an individual exhibits the thinking of a particular stage of intellectual development. This conclusion, in turn, supports the findings of Lawson and Renner (1974), of Flavell (1977), Novak (1978), Wilson and Wilson (1984), King (1961) among other investigators.

The comparison made between the performance of the children of the two cultures, especially as regards the nine questions set for this purpose, revealed very slight variations in the percentages of those attaining the late formal operations stage at each age level, though there was no variation at all at this stage when the age levels were amalgamated (26.5 per cent of each Egyptian and

English children).

The slightly higher performance of the Egyptians at ages 11 and 13 was compensated by the slightly higher performance of English children at age 15 (Table 7.34). This could approximately be said about the children's attainment of the late concrete level (45.7 per cent of the Egyptians, 42 per cent of the English. Thus, when taken collectively the whole data gave no evidence for cultural variations in performance, though there were differences, sometimes significant, in the performance of the children of the two cultures on some individual questions. This conclusion gave answer to the third hypothesis that cognitive development in Egyptian children regarding science concepts could follow the same sequential succession of concrete and formal stages and substages, without the accurately definite age, suggested by Piaget in Middle-Class Western children (English).

Because of the kinds of educational experiences concerning the scientific knowledge acquired for application to the concepts tested, cultural factor did not tend to play a highly significant role in the performance of the children of both cultures. It is suggested that the differences between Egyptian and English systems of education and examinations would count for:-

a) the differences which appeared between children of the same age level in some individual questions,

b)the higher performance of the Egyptians at age 11 on the whole test is compared to that of the English of the same age (Table 7.32), and on the nine questions set for comparison (Table 7.34),

c)the slightly lower performance of the Egyptians than that of the English at age 15 on the nine questions set for comparison, though the Egyptians performed better than the English on the whole test, and

d)the steady performance of the Egyptians at age 13 on the whole test as well as on the nine questions set for comparison.

The conclusion drawn from this would answer the fourth hypothesis: as regards the development of science concepts, the average age at which children pass through concrete and formal stages would vary from one country to another according to cultural differences regarding the systems of education and examinations.

The results of the comparison between the performance of boys and girls indicated the existence of a significant relationship between the children's attainment of late formal operation and sex concerning science concepts. These conclusions give support to Shayer (1978), and Shayer and Wylam (1978). Shayer (1978) ascribed sex-differential to the factors of age, environment and genetics. By age he maintained that basic intellectual development ceases after puberty and the boys have their final boost because of their later sexual and bodily

development. About the factor of environment Shayer argued that the boys are more concerned with the physical world, while girls are more interested in talking about people. In explaining the genetic differences he assumed that for girls it would be slightly 'more' difficult to learn to apply their intelligence to the problem of coordinating the dimension variables in a drawing problem.(1) The results shown in Tables 7.30 and 7.31 may support Shayer's arguments.

- *****
- 1- M. Shayer, "A Test of the Validity of Piaget's Construct of Formal Operational Thinking", Ph.D. Thesis, University of London, 1978, pp. 212-220.

CHAPTER EIGHT

CONCLUSION

'The cross-cultural data do not support every aspect of Piaget's theory, nor do they disprove it ; rather, they call for an expansion of the theory that will attribute a greater importance to cultural factors.'

(Dasen and Heron, 1981)

* * * * *

The subject-matter of Piaget's numerous works lay in his life long search for a well-grounded theory of the construction of knowledge. Although his theory of intellectual development constitutes the core of the largest repository of the twentieth century developmental psychology, its division into definite age stages has been subject to much repudiation as well as confirmation, which provoked positively or negatively so many workers to undertake their related investigations in the field. The main four stages of Piagetian development are the sensori-motor, the pre-operational, the concrete operational, and the formal operational.

During the child's pre-operational stage of the development, the child, according to Piaget develops three basic characteristics of his mental structure: contradiction, egocentricity, and animism. Contradiction and egocentricity are considered contributing factors in shaping the child's animistic thinking. Piaget sees animism as the child's limitations to distinguish between himself and the outside world, and therefore he is always spontaneously inclined to ascribe life and consciousness to inanimate objects.

The child develops his animistic thought through four stages beginning from 5 years when his attribution of life is based on the active condition of an object, at 6 to 8 years he attributes life to objects that move, at 8 to 12 years to things that move spontaneously, and in the fourth

stage his attribution of life is confined to animals and plants.

As the most fundamental characteristic of the preoperational period of Piagetian stage development theory, animism has been investigated by many researches who have come to conflicting conclusions. Animism was confirmed through a series of studies undertaken by Russell and Dennis, by Bruce (1941), and by Safier (1964), while it was repudiated by Mead (1932), Berzonsky (1970, 1971b, 1974), Siegler and Richards (1983), and Bullock (1985) among many others.

The importance of Piaget's theory of animism in the child's development of science conceptualization has motivated the present researchers to undertake a preliminary study of animism as part of the whole cross-cultural study of science conceptualization in Egypt and England a total of 389 subjects aging from 5 to 11 years and selected from Egypt and England were interviewed about 19 items (five alive), six dead, and eight inanimate).

The results obtained did not substantiate Piaget's claim that animistic tendency is a spontaneous characteristic in the child's intellectual structure. Animistic responses of the children were very little in most of the cases tested. Even when the animistic thinking rose, it occurred among older children, which did

not corroborate Piaget's hypothesis that animistic thinking decreases with increasing age.

Another feature of the results was that in most cases of animistic responses children tended to give natural explanations for their wrong answers and did not base their judgement on either movement or spontaneous movement of the item tested. So, movement was hardly a criterion according to which life was ascribed to inert objects (King, 1961). A further conclusion of the results was that the children's concepts of life and death tended to corroborate with increasing age, with no evidence that their accurate concepts of life and death moved in four definite stages of age development (Huang and Lee, 1945; King, 1961; Smeets, 1974; Smith and Dougherty, 1965).

There were no statistically significant variations in the performance between boys and girls. So, gender was no substantial variable in the children's performance of the concepts of life and death. Cultural and environmental factors tended to play a significant role in the percentages of children who attributed either life or death to some inanimate items.

Two major stages in Piaget's theory of intellectual development are the concrete and formal operations stages. Each stage is characterized by 'operations', or ways of thinking, peculiar to it. The more the child develops, the more integrated the operations become and form a

'structured whole'. The concrete and formal thinking stages are, therefore, controlled by internal coherence or structure obeying definite laws of composition, and each stage has its distinct mental structure. Although the child of the concrete operational stage is able to reason logically, his reasonings, or reversible operations are limited to concrete things. The child is not able to think hypothetically and propositionally until he reaches the formal operational stage.

Against the Piagetian stage-theory of intellectual development Robert Gagne does not relate intellectual development to the processes of growth, but to the growing change in an individual's behaviour when he is placed in a learning situation. The development of a learner is determined by his previous experience relevant to the new situation. Instead of age-range stages of development Gagne identifies cognitive development in terms of eight hierarchical steps developing from the simplest to the most complex. Gagne identifies the most complex in his hierarchical networks as problem solving. He also specifies four sequential phases of events in the processes of learning: 1)the apprehending phase, 2)the acquisition phase, 3)the storage phase, and 4)the retrieval phase.

Like Gagne, David Ausubel emphasizes the importance of the previous relevant knowledge of the learner in his cognitive development. Verbal methods are more effective

in the process of learning than activity professed by Piaget. Cognitive development is controlled by the integrated acquisition of specific concepts. There are seven major constituent concepts in Ausubel's theory of intellectual development: 1) meaningful learning in which the individual can relate new ideas to what he has already learned, 2) subsumption which means the integration of the new knowledge with the existing structure, 3) obliterative subsumption which means the forgetting of the details of already learned ideas for the assimilation of new relevant ideas into the structure, 4) progressive differentiation which means the gradual presentation of interrelated concepts, so that the newly acquired knowledge may be subsumed, 5) superordinate learning in which an inclusive new concept subsumes the relevant already learned aspects, 6) integrative reconciliation which means the integration of new concepts and seemingly contradicting established concepts into new meanings, and 7) advance organizers which means the introduction of general principles relevant to the more detailed newly learned materials. Thus Ausubel's theory repudiates Piaget's operatory structures, and professes intellectual development as arising from the ~~cumulative~~ learning of prior skills.

The present study has been conducted to investigate Egyptian and English children's development of science conceptualization in relation to Piaget's theory. For the assessment of the children's attainment of concrete and

formal stages, 502 children participated in the study (270 Egyptians 232 English). The subjects ages were 11, 13, and 15 years. They were taken from the schools of Aswan and Tanta in Egypt, and Durham in England. The children of ages 11 and 13 were tested on the concepts of the three branches of science through thirty seven questions (15 biology, 10 chemistry, and 12 physics). The children of age 15 were tested through twenty five questions (10 biology, 6 chemistry, and 9 physics).

The results obtained revealed that:-

- 1- There was clear evidence that the children of both countries attained concrete and formal stages of cognitive development in varying degrees of performance on scientific concepts.
- 2- There was no evidence that the children development was determined by a definite age-range stage, although there was a substantial correlation between age and the attainment of late formal operational stage.
- 3- There were very slight variations in the performance of Egyptian and English children of ages 13 and 15 on the task set for the cultural comparison. while the difference was considerably wide at age 11, particularly in the children's attainment of the late formal operational stage.
- 4- This difference between Egyptian and English children of age 11 could mark the only cultural factor. The noticeably higher performance of Egyptian children of age

11 compared to that of the English children of the same age could be ascribed to the differences between the Egyptian and the English systems of education and examinations. At age 11, Egyptian children have to undertake the examination of the Primary School Certificate, which requires hard work, private lessons and serious preparation for obtaining high marks without which the pupil cannot enter government preparatory schools. Moreover, the amount of science taught in grade six of Egyptian primary schools (age 11) is greater than that learned by the English pupil by the same age. When asked 'how much science have you done?', many English children of age 11 wrote 'none'.

5- On the comparison between boys and girls, there were statistically significant differences in favour of boys, especially in the attainment of the late formal operation. The wide difference between Egyptian boys and girls of age 15 in the attainment of late formal operations stage might be ascribed to the fact that at the end of the first year in secondary school students have to choose either literary or scientific subjects to study in the successive years. The majority of girls are inclined to take the literary section. therefore they are more concerned with literary subjects and their interest and motivation in learning science is seriously reduced.

The results tended to support Ausubel's and Gange's view that an individual can think hypothetically when he

acquires proper relevant knowledge about the concept or the problem tested. Individuals are different in their capability of retaining already established knowledge, so they are different in their capability of assimilating a newly relevant piece of knowledge. It was noticeable that the majority of children tested performed much better on the questions involving general information about the concept questioned. This may add weight to Ausubel's concepts of 'advance organizers' as a facilitating factor in the process of science teaching regardless of the age levels of the learners.

There was also the possibility that the children who failed to answer some questions did so because of their lack of familiarity with the concept tested. For instance the lowest performance of the whole of the English sample was on the questions testing the two processes of respiration and photosynthesis. None of the English children of age 11 mentioned either of the two terms in their responses. This was not the case with the Egyptian children of age 11 who correctly answered these questions referring to one and/or the two terms because the two processes are taught through the science curriculum of the six year in the primary school. Thus the advance organizers in the meaningful learning seemed to help them in understanding the concept in this particular case.

APPENDICES

Appendix I

SCIENCE TESTS FOR ENGLISH CHILDREN

AGES 11, 13, AND 15

NAME :

DATE OF BIRTH :

DAY	MONTH	YEAR

SEX :

BOY

--

GIRL

--

SCHOOL :

HOW MUCH SCIENCE HAVE YOU DONE? :

Conducted by Salwa M. Khalil
SCHOOL OF EDUCATION,
UNIVERSITY OF DURHAM

INSTRUCTIONS

The questions in this test are to find out how you think about problems. In some questions all the information you need is given to you. In others you need to use ideas you may have learned at home or at school.

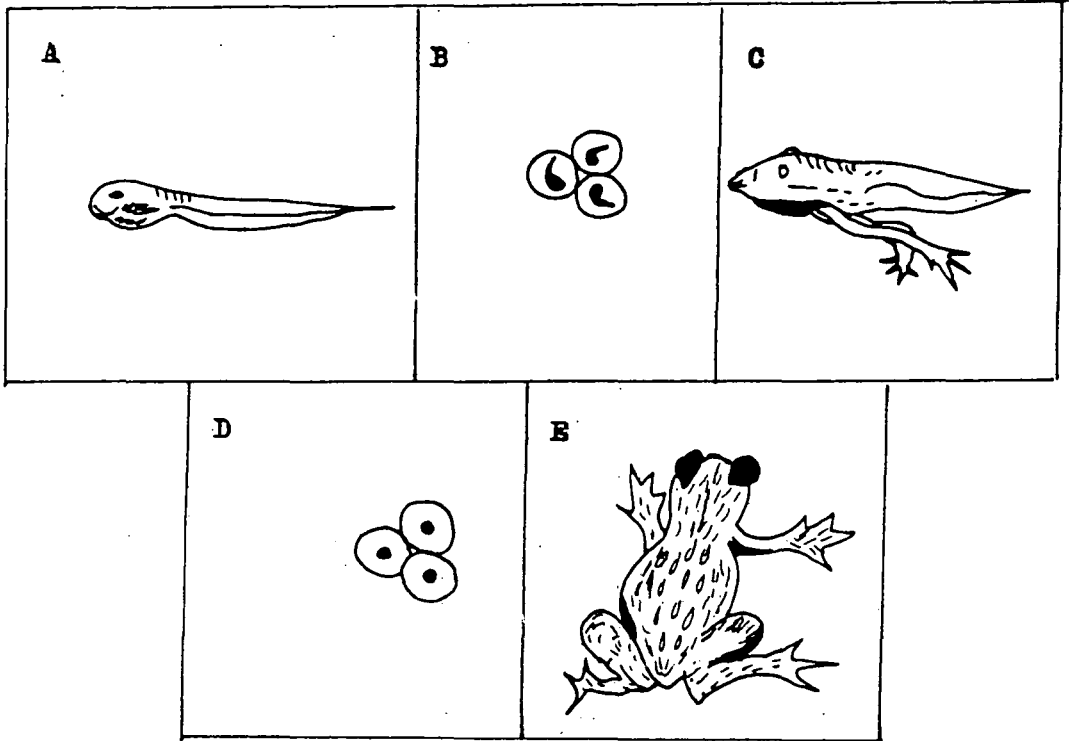
We are very interested in your ideas so try every question, even if you are not completely sure of the answer.

- * Please read each question carefully.
- * Put up your hand if you need help in reading a question.
- * Each question is on a separate page. You answer some questions by putting a tick or cross in a box. In other questions you write your answer in the spaces provided.
- * Work through the questions at your own rate - there will be enough time for you to try them all.
- * We hope you will find the questions interesting.

Tests of Biological Concepts for
Ages 11 and 13

Question 1: "Life Cycle" (2 A)

These are all stages in the life of a frog , but they are jumbled up.



Write the letters of the pictures in the order in which they happen

.....

Qestion 2: "Food Chain" (2 A)

A food chain shows how different living things depend on each other for food . The sign $B \leftarrow A$ means that B eats A .

Below are listed five food chains but one is not possible .

☐

STOAT \leftarrow RABBIT \leftarrow GRASS

☐

OWL \leftarrow TERUSH \leftarrow CATERPILLAR \leftarrow MUSHROOM

☐

FROG \leftarrow LADYBIRD \leftarrow GREENFLY

☐

BLACKBIRD \leftarrow BUTTERFLY \leftarrow PANSY \leftarrow MOSQUITO

☐

MAN \leftarrow PIKE \leftarrow PERCH \leftarrow MINNOW \leftarrow WATER FLEA

Question 3: "Fish Tank" (3A)



When the light was on in the fish tank the fish spent more time near the surface than near the bottom of the tank .

Think of two different reasons why they might prefer to swim near the surface.

Write the first at (a) and the second at (b).

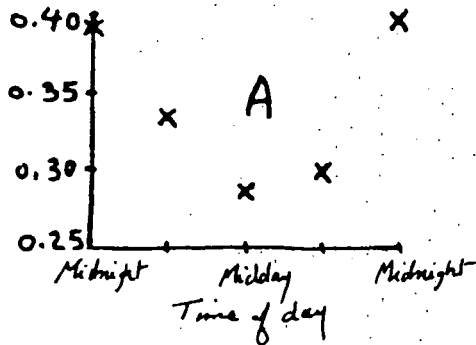
(a) I think this might be because
.....
.....
.....
.....

(b) or it might be because
.....
.....
.....
.....

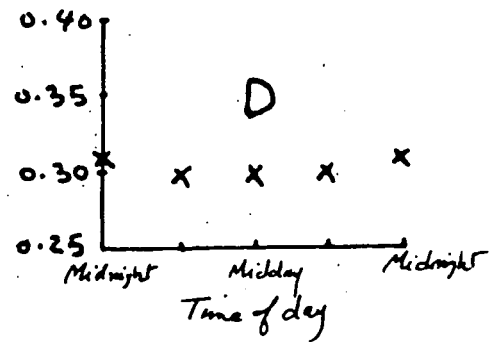
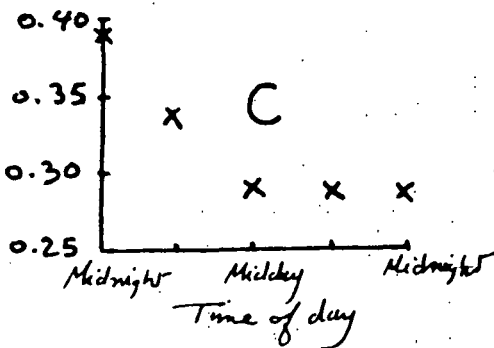
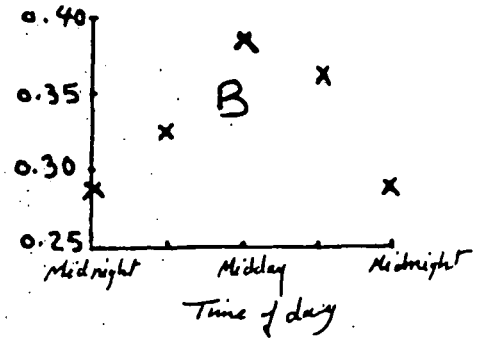
Question 4: "Field of Grass" (28)

The carbon dioxide concentration in the air (amount of carbon dioxide %) was measured over a field of tall grass and over a newly ploughed field. The measurements were taken every six hours during one full day. The results for both fields are shown among the graphs below.

Amount of carbon dioxide %



Amount of carbon dioxide %



- a) Which of the graphs A, B, C or D shows the carbon dioxide concentration in the air over the field of tall grass ?

Tick in the box next to the one you choose .

☐ A

☐ B

☐ C

☐ D

- b) Which of the graphs A, B, C or D shows the carbon dioxide concentration in the air over the newly ploughed field ?

Tick in the box next to the one you choose .

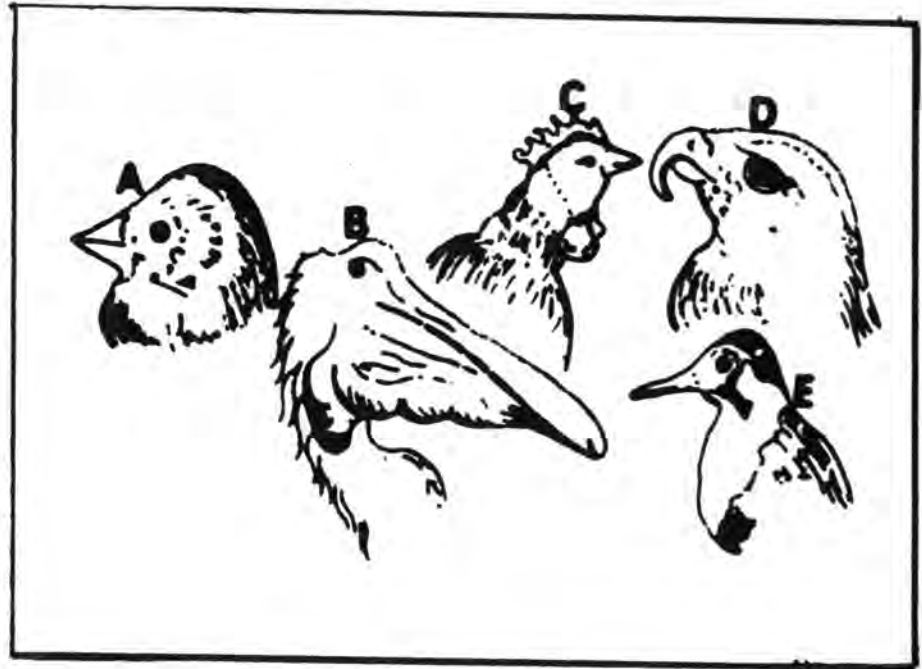
☐ A

☐ B

☐ C

☐ D

Question 5: "Beak Shapes" (28)



a) Which two of these would you expect to eat the same kind of food ?

.....

b) Why do you think they might eat the same kind of food ?

Because

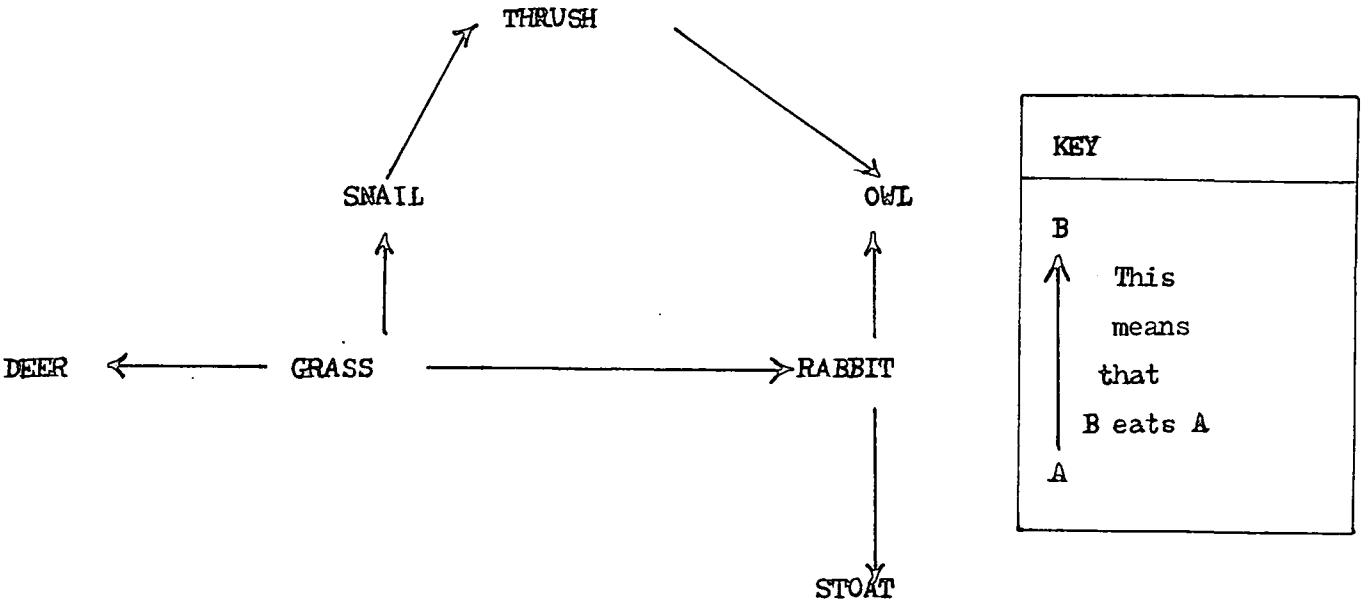
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.....

.....

Question 6: "Food Web" (3B)



Use the information in the diagram to answer the following questions :

a) If the number of rabbits increases which groups of animals might increase as a result ?

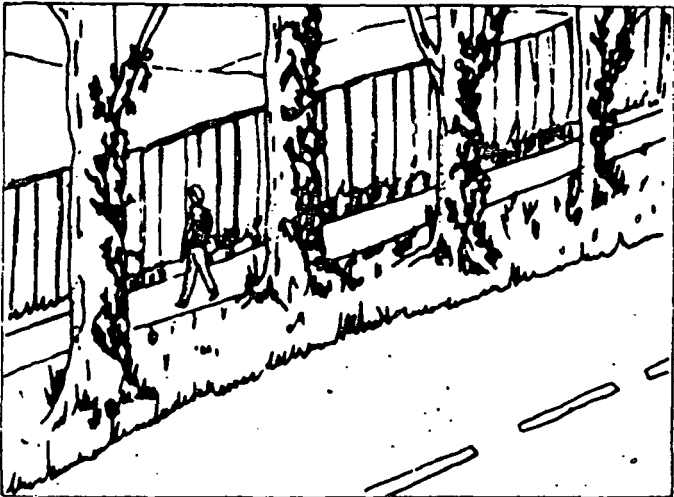
.....
.....
.....

b) If the number of rabbits increases which groups of animals might decrease as a result ?

.....
.....
.....

Question 7: "Ivy" (3A)

Walking along this footpath Thomas noticed that there was ivy growing on the trees but only round three - quarters of the trunks . None of the trees had ivy growing on the side nearest to the path .

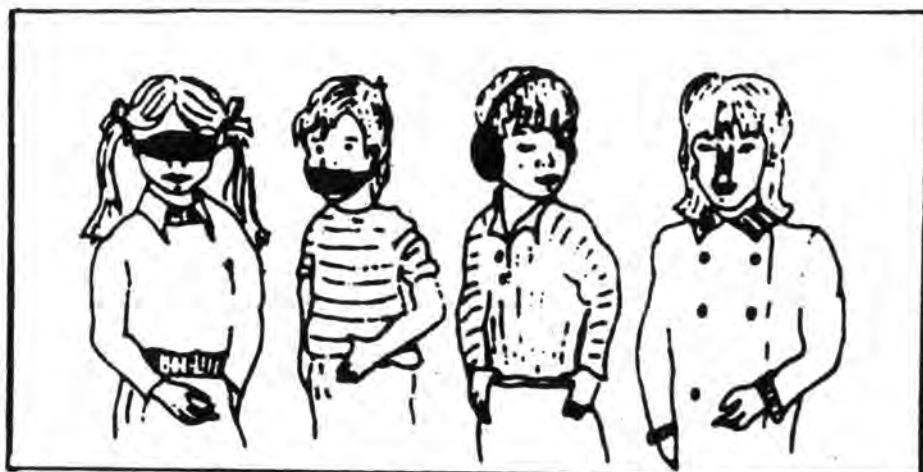


Think of two different reasons why the ivy might grow only on some sides of the trees . Write the first at a) and the second at b)

a) I think it might be because
.....
.....

b) Or it might be because
.....
.....

Question 9: "Senses" (2B)



a) Which of these things could all of these people still be able to tell ?

Tick in any box which is true .

☐


Is the drink coffee or tea ?

☐


Is the rose orange or red ?

☐


Is the pie hot or cold ?

☐


Is the watch ticking or not ?

☐


Is the soap scented or not ?

b) Why do you think it is this one ?

Because

.....

.....

.....

Question 10: "Grasshoppers" (2B)

Grasshoppers attract their mates by using sound .

Peacocks attract their mates by using colour .

Suggest three possible reasons why grasshoppers use sound rather than colour.

(1)
..... ,
..... ,

(2)
.....
.....

(3)
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.....

Question 11: "Goosegrass" (2 β)

Below are drawings of two goosegrass plants , P and Q . One was found on open waste-land . and one growing up through a hedge .



Tall and thin



Short and thick

a) Which goosegrass , P or Q , would you expect to find growing

(1) in the hedge

(2) on waste-land

b) Give reasons for your choice .

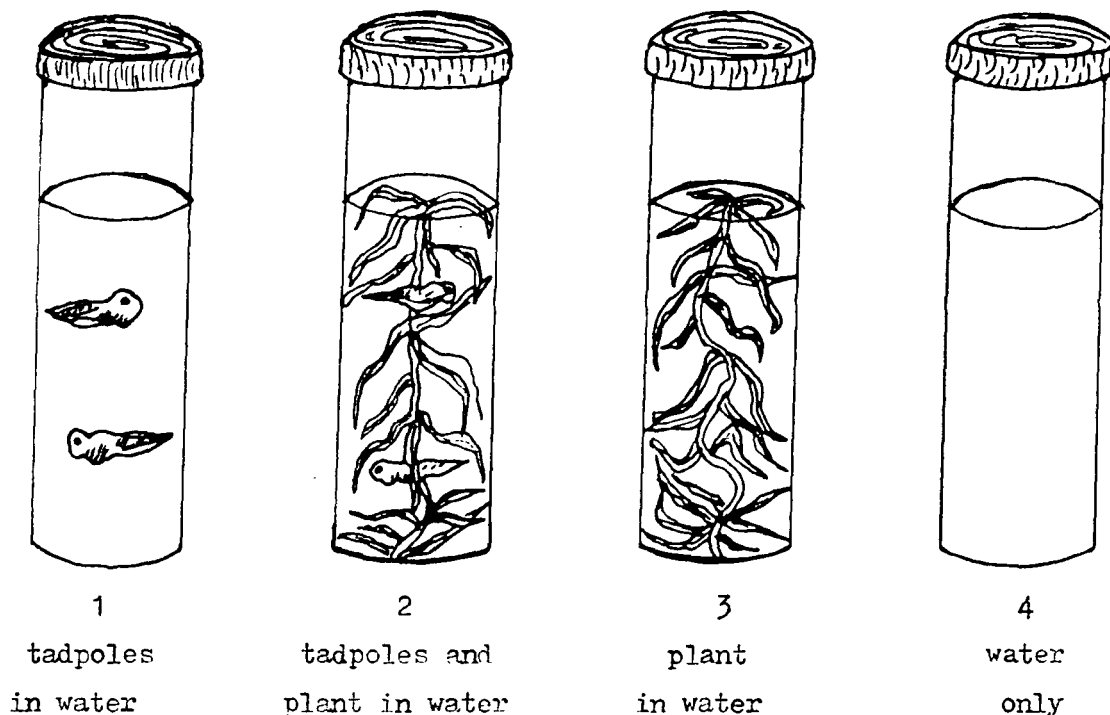
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Question 12: "Gas Balance" (3B)

Early one morning four containers were set up as shown in the diagram .
The tops were air - tight .



They were left in a well lit place for eight hours. After this time it was suggested that the water in two of the containers would have about the same amounts of oxygen and also about the same amounts of carbon dioxide.

Say what happens in each container and say why you agree or disagree with the suggestion.

Container One

.....

Container Two

.....

Container Three

.....

Container Four

.....

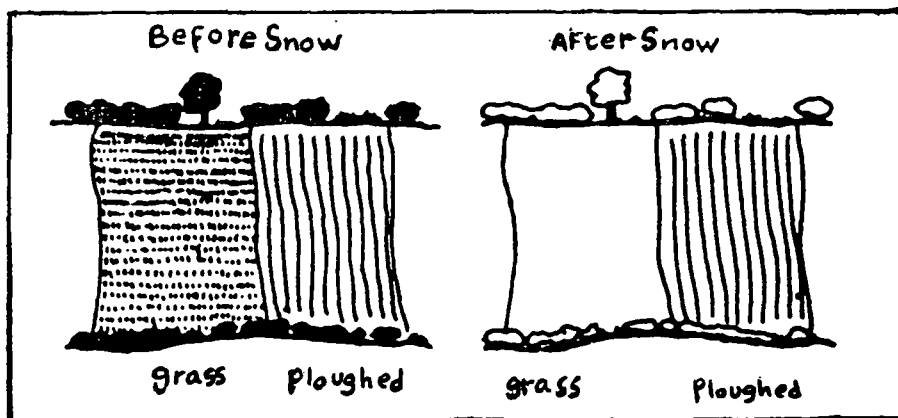
Why do you agree or disagree with the suggestion ?

.....

.....

Question 13: "Snow in Fields" (2A)

The drawing shows two fields next to each other, one freshly ploughed and one covered with grass. After a snow storm Jane could see more snow on the grass than on the ploughed field.



Think of two different reasons why Jane could see more snow on the grass.
Write the first at (a) and the second at (b).

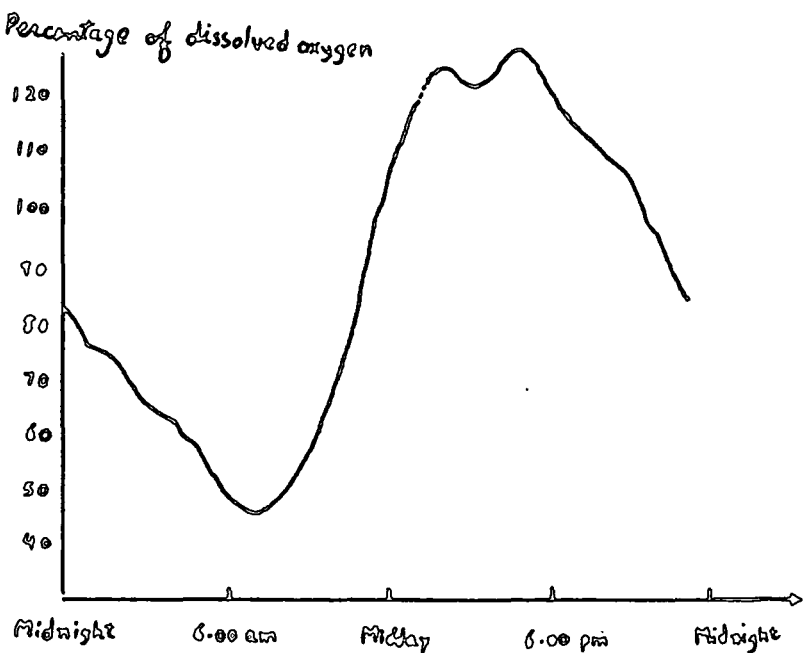
(a) It could be because
.....
.....
.....

(b) Or it could be because
.....
.....
.....

Question 14: "Stream" (3B)

The amount of oxygen dissolved in a stream is changed by the plants and animals living in it.

This graph shows the change in the amount of oxygen dissolved in the stream during one full day.

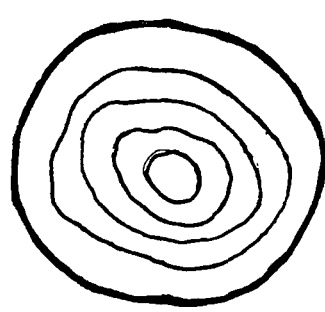


- a) Why does the amount of oxygen in the stream steadily decrease from 6.00 in the evening until 6.00 in the morning ?
-
-
-
-
-
- b) Why does the amount of oxygen in the stream increase after 6.00 in the morning?
-
-
-
-

Question 15: "Tree Section" (38)

If we cut across the trunk of a tree we see 'growth rings'. These rings mark where the tree starts to grow rapidly after a period of very slow growth .

Here is a picture of a section of a tree with four growth rings .



How old do you think such a tree would be :

a) if it came from a forest in England ?

.....years

b) if it came from a forest in a tropical country with two rainy and two dry seasons each year ?

.....years

How did you decide ?

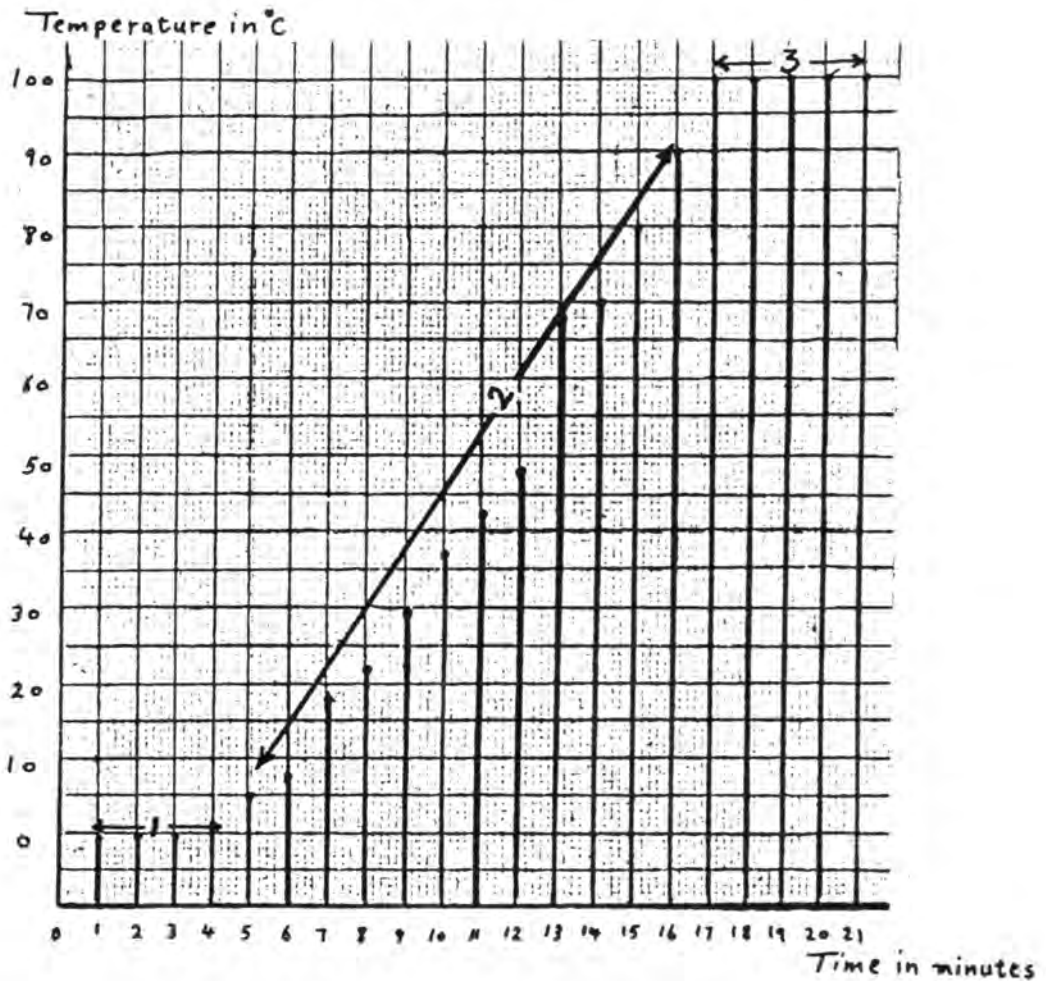
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Tests of Chemical Concepts for Ages 11 and 13

Question 1: "Melting Ice" (3A)

The temperature of water in a beaker was measured when it first came out of the fridge in the form of crushed ice. Then it was measured every minute while it was being heated.

The results are shown in the chart below.



The chart has been divided into three parts - 1, 2, and 3.

Answer the questions below using **any** of the following words:

ICE , WATER , STEAM

You can use more than one word in answering each question.

a) What would you see in the beaker in part 1 of the chart ?

.....

b) What would you see in the beaker in part 2 of the chart ?

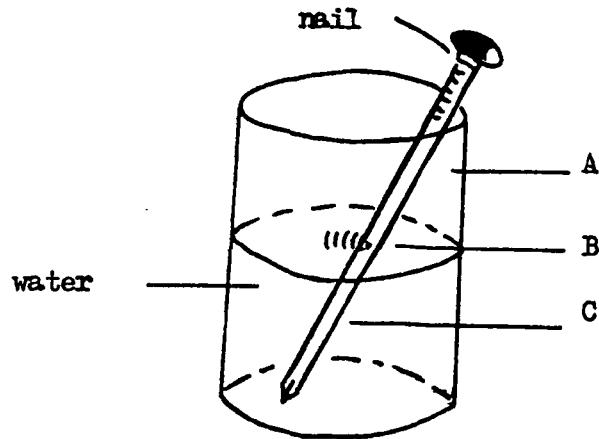
.....

c) What would you see in the beaker in part 3 of the chart ?

.....

Question 2: "Nail" (2B)

A bright , shiny nail was left for a few days in a jar half - full of water , as shown in the diagram below .



a) Where would you expect the nail to rust most ?

- A At A
- B At B
- C At C
- D It would rust evenly all over

b) Give the reasons for your choice of answer .

.....

.....

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.....

Question 3: "Heating Elements" (3A)

A pupil carried out an investigation of several different elements , both metals and non-metals. She heated each element on flameproof paper and found the mass before and after heating .

She wrote down her results in the table .

Element	Mass before heating	Mass after heating
Iron	2.00 g	2.03 g
Carbon	2.00 g	0.20 g
Sulphur	2.00 g	0.00 g
Aluminium	2.00 g	2.02 g
Copper	2.00 g	2.03 g
Iodine	2.00 g	0.03 g
Magnesium	2.00 g	2.83 g

- a) If the pupil now heated the element zinc , what would you expect to happen to its mass ?

.....

.....

- b) How did you work this out ?

.....

.....

.....

.....

Question 4: "Heating Compounds" (2A)

Four compounds P, Q, R and S were heated gently in separate test tubes. The changes that were observed are written down in the table below.

Compound	Colour before heating	Colour when hot	Colour when cold	Change in mass
P	White powder	Yellow powder	White powder	None
Q	Brown powder	Brown powder	Brown powder	None
R	White crystal	White crystals	White crystals	None
S	Green powder	Black powder	Black powder	Loss

a) Which compound changes on heating but re - forms on cooling ?

- ☐ A Compound P
- ☐ B Compound Q
- ☒ C Compound R
- ☐ D Compound S

b) Which compound has reacted on heating ?

- ☐ A Compound P
- ☐ B Compound Q
- ☐ C Compound R
- ☐ D Compound S

Question 5: "Coal and Oil" (3 A)

Two common fossil fuels used in Britain are oil and coal .

Coal is a solid fuel and oil is a liquid fuel .

Deposits of these two fuels have been discovered on land .

The fuels have to be removed from below ground and then transported .

Think of three possible reasons why it might be easier to remove a liquid fuel like oil from below the ground , rather than coal .

- (1)
.....
.....
- (2)
.....
.....
- (3)
.....
.....

Question 6: "Acid and Alkali" (2 A)

A pupil was trying to ~~change~~ the pH (acidity) of 10 cm^3 of nitric acid by adding something to it .

Which one of the following suggested additions would not alter the acidity ?

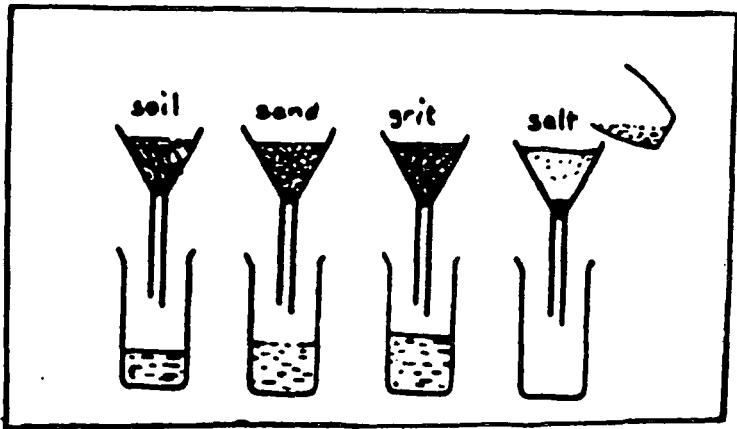
Tick in the box next to the suggestion you choose .

- ☐ A 5 g of calcium metal
- ☐ B 10 cm^3 of the same nitric acid
- ☐ C 5 g of magnesium metal
- ☐ D 10 cm^3 of alkali
- ☐ E 10 cm^3 of pure water

Question 7: "Solution" (2 B)

David and John put equal amounts of dry sand, soil, grit and salt in four funnels. They wanted to find out how much water each one would soak up. So they poured 100 ml of water into each one.

This worked all right until they came to the salt. When they poured the water in almost all the salt disappeared.

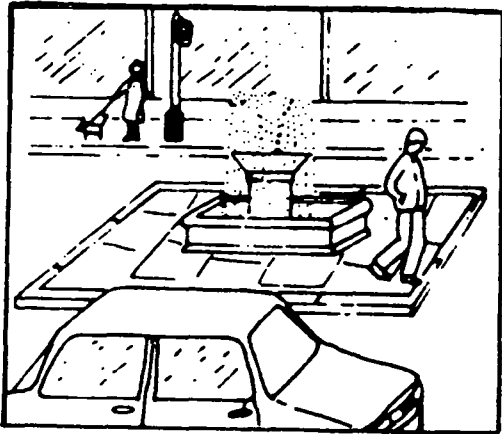


Why do you think the salt disappeared but the other solids did not ?

I think this might be because
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.....
.....
.....

Question 8: "Fountain" (28)

A smooth marble fountain was built in the middle of a city .



After several years the surface of the marble was worn and covered with
small holes .

Think of three reasons , other than damage by the people , which could
have caused the small holes to form .

.....

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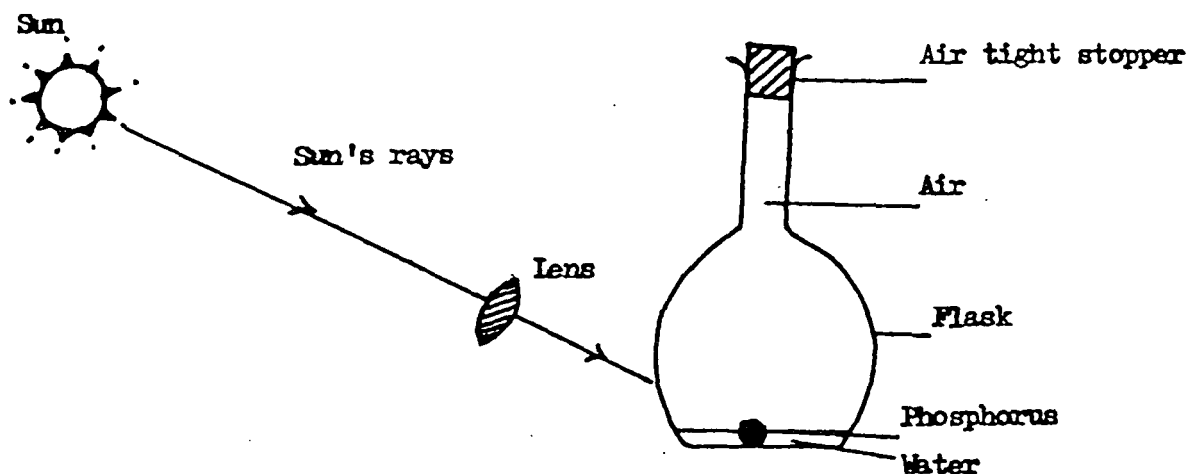
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Question 9: "Phosphorus" (38)



A piece of phosphorus was held in a flask as shown in the diagram. The mass of the flask and contents equalled 205 g. The sun's rays were focussed on the phosphorus, which then caught fire. The white smoke produced slowly dissolved in the water. After cooling, the flask and its contents were weighed again.

a) Would you expect the weight to be :

- ☐ A More than 205 g
- ☐ B 205 g
- ☐ C Less than 205 g
- ☐ D Not enough information to answer

Tick in
the box
next to
the answer
you choose.

b) Give the reasons for your answer :

.....

.....

.....


.....

.....

Question 10: "Reactivity" (3A)

The reactivity of four common metals is in the following order :

1. Zinc	—	most reactive
2. Iron	—	
3. Lead	—	
4. Copper	—	least reactive



A pupil was asked to heat small quantities of these mixtures .

- a) iron powder and copper oxide
- b) iron powder and lead oxide
- c) iron powder and zinc oxide

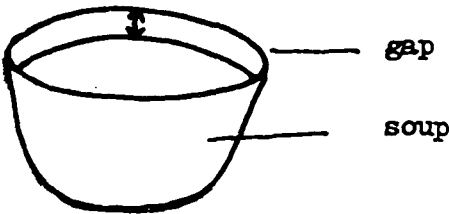
What will happen in each experiment ?

- a)
.....
- b)
.....
- c)
.....

Tests of Physical Concepts for Ages 11 and 13

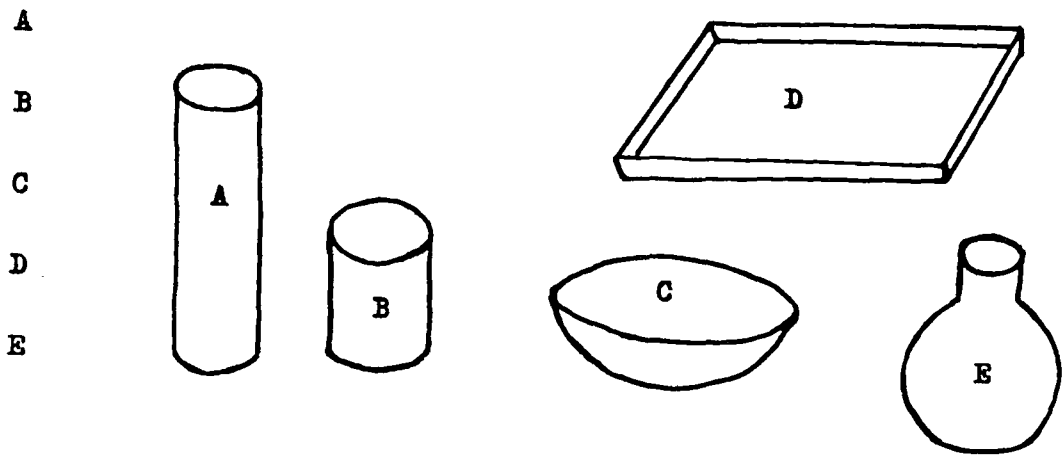
Question 1: "Freezing" (3A)

When you freeze soups , sauces or stews , you are always advised to leave a gap at the top of the container .



If the following containers can all hold the same amount of liquid , which one would you fill closest to the top ?

Tick in the box next to the letter of the container you choose .



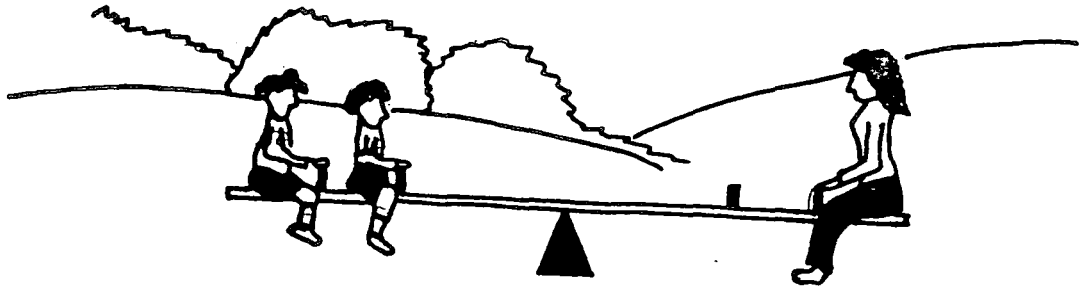
Give a reason for your answer

.....

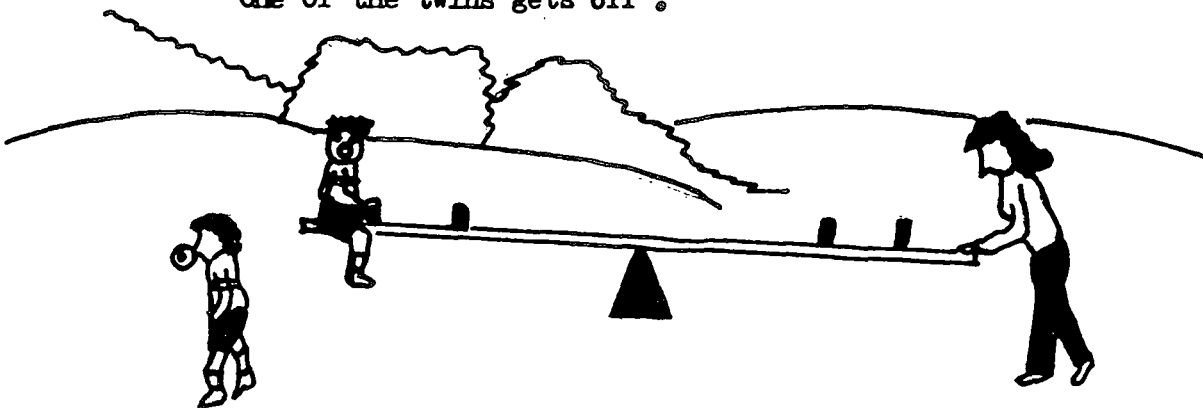
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Question 2: "See-Saw" (2 A)

A mother has a see - saw with her twin boys .



One of the twins gets off .



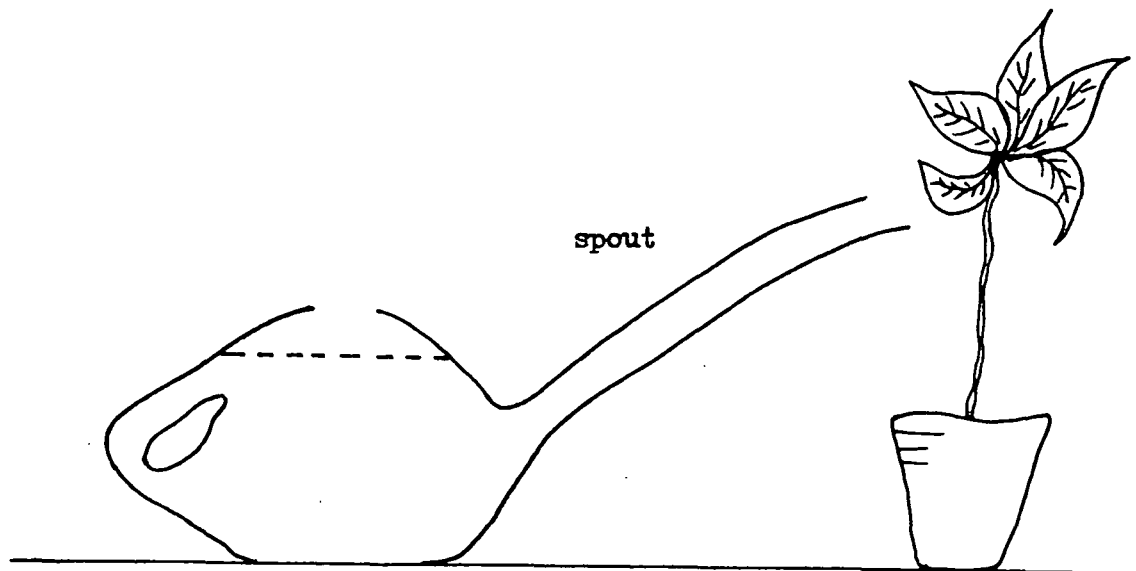
The mother wants to balance the twin that left behind .

Where should she sit ?

Tick in the box next to the answer you agree with most .

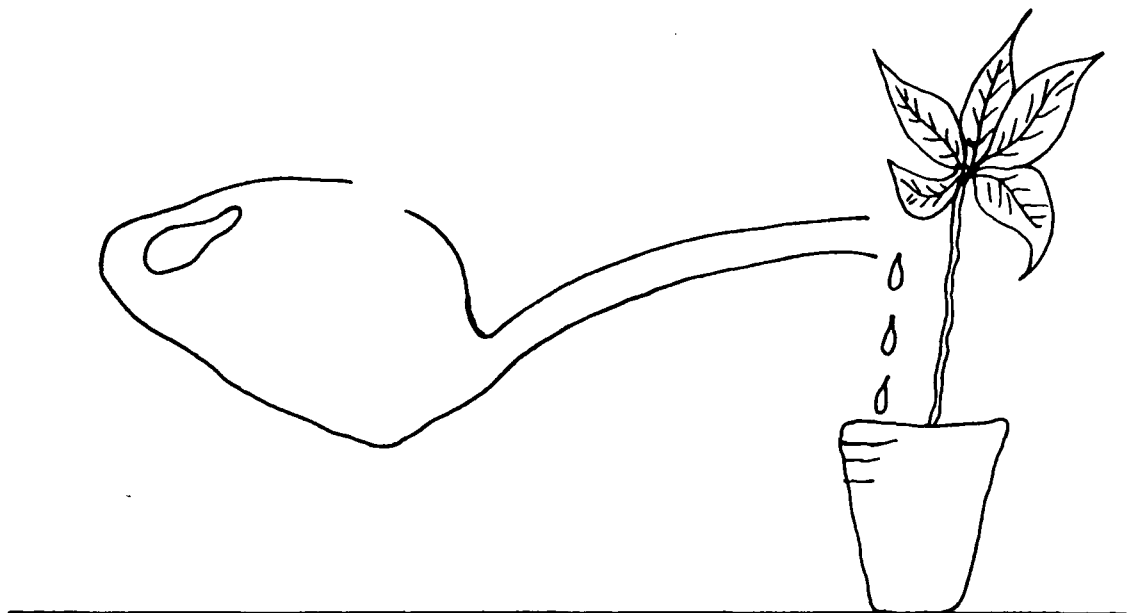
- A Right at the end of the see - saw
- B A little way in towards the middle
- C Half way in to the middle
- D Close up to the middle

Question 3: "Watering Can" (3A)



(a) The dotted line shows where the surface of the water is in this watering can.

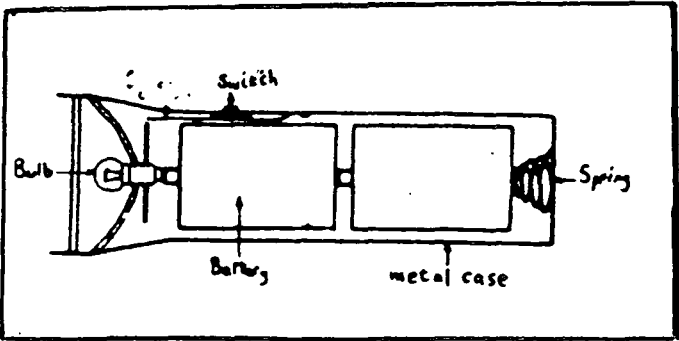
Draw a line to show where the surface is in the spout.



(b) The watering can is tipped so that the water just begins to drip through the spout.

Draw a line to show where the water surface is now.

Question 4: "Torch" (2 B)



The diagram shows the inside of the torch

Mr. X has a torch like the one in the diagram but it does not work .
The spring at the bottom of the torch is all covered in rust .
After cleaning it down to the shiny metal , the torch works .

Why does cleaning the spring make the torch work ?

.....
.....
.....

Question 5: "Car Tyre" (3A)

Scientists have a theory that everything is made of small particles .

The theory states that :

These particles move in all directions .

These particles move faster the higher the temperature .

These particles exert forces on each other .

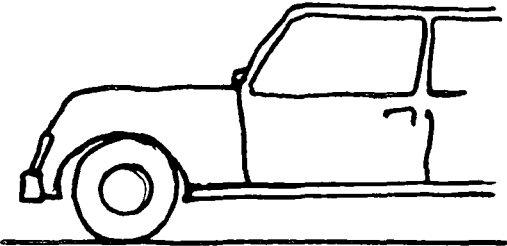
These particles are too small to see through a microscope .

These particles of different substances are different sizes .

Use any of these ideas to help answer the following question .

Why does the pressure in car tyres
increase during a journey ?

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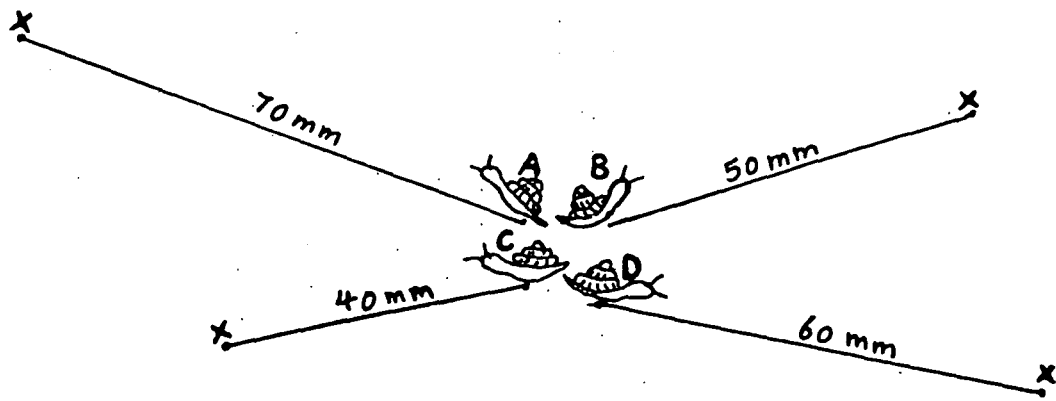


Question 6: "Snails" (2 B)

How fast do snails go ?

To find this out John and Pamela put four snails down next to each other and marked their trails .

They put a cross (X) where each snail reached after 30 seconds .



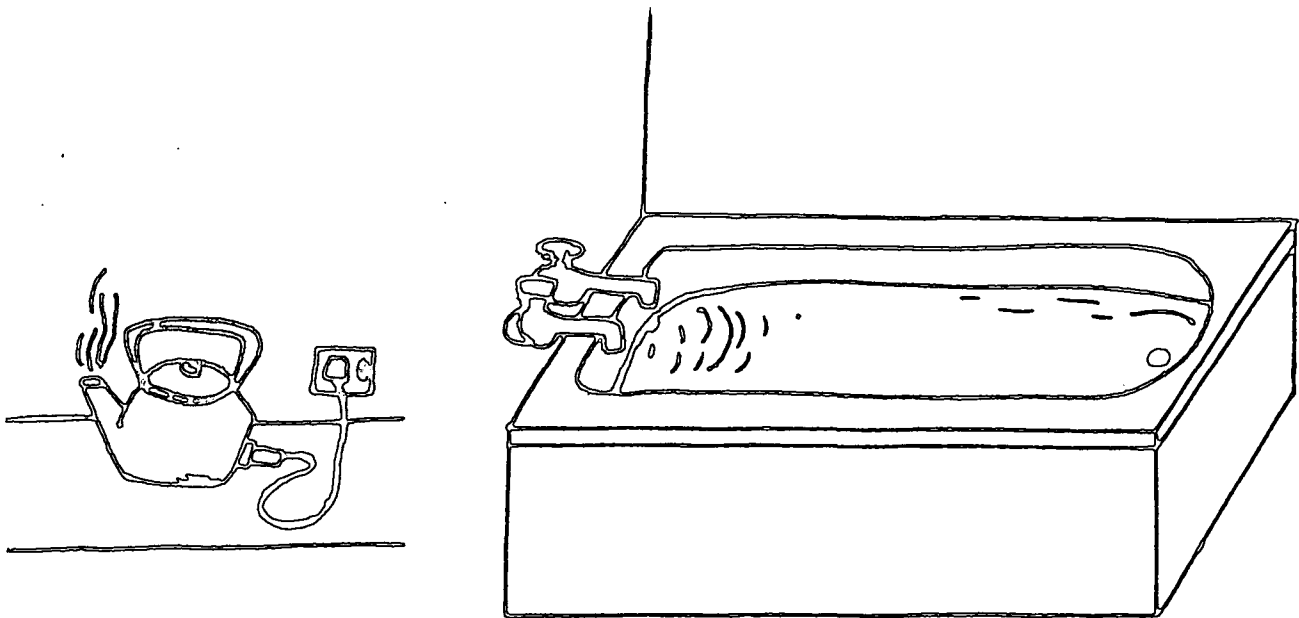
(a) Which snail went fastest ?

.....

(b) If snail C went on at the same speed for another 15 seconds how far would it go beyond X ?

.....

Question 7: "Kettle and Bath" (3B)



An electric kettle was filled with water and brought to the boil .

A bath was filled with water just above body temperature to the level shown .

a) If the water in the kettle and in the bath were both heated by electricity ,
which would cost more to heat ?

.

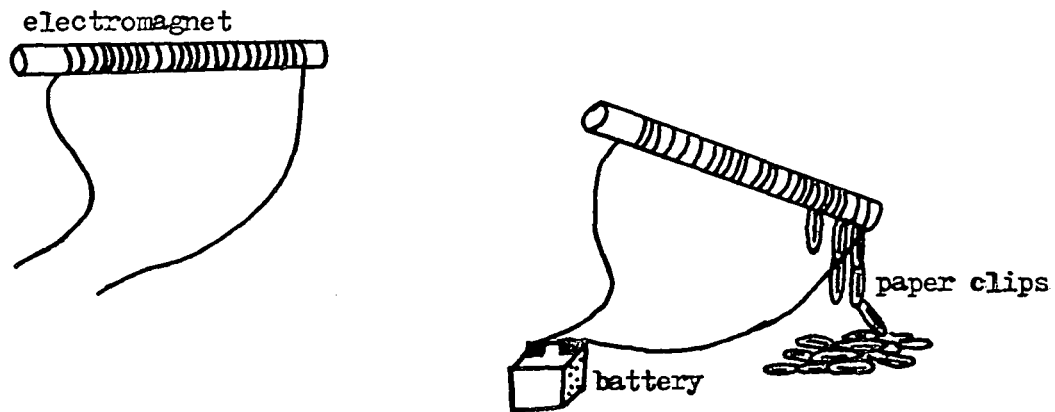
b) Give the reasons for your answer .

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Question 8: "Electro-magnet" (3A)

Mary has made an electromagnet by winding a piece of wire round something tall and thin .

She connects the ends of the wire to a battery, and shows her younger brother how it will pick up a lot of paper clips from a pile on the table .



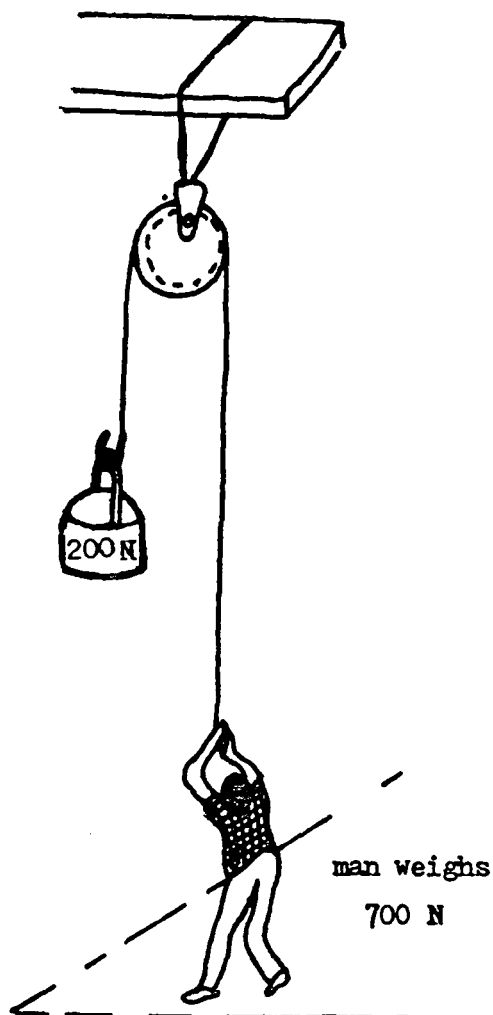
Her brother goes away and tries to make one like Mary's for himself.

His electromagnet does not work nearly as well as Mary's .

Think of three reasons to explain why his works badly

- (1)
.....
.....
- (2)
.....
.....
- (3)
.....
.....

Question 9: "Man" (2 B)



A man on a building site has lifted a bucket of cement , as shown in the diagram .

What would you expect the force of the man's feet on the ground to equal ?

Tick in the box next to the one you choose .

A 100 N

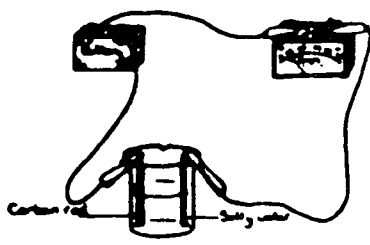
B 200 N

C 300 N

D 500 N

E 700 N

Question 10: "Salty Water" (2B)



John set up the circuit shown in the diagram. He noticed the ammeter reading was 0,2 amps. He added an extra tablespoon of salt to the salty water , and stirred it up without disturbing the carbon rods.

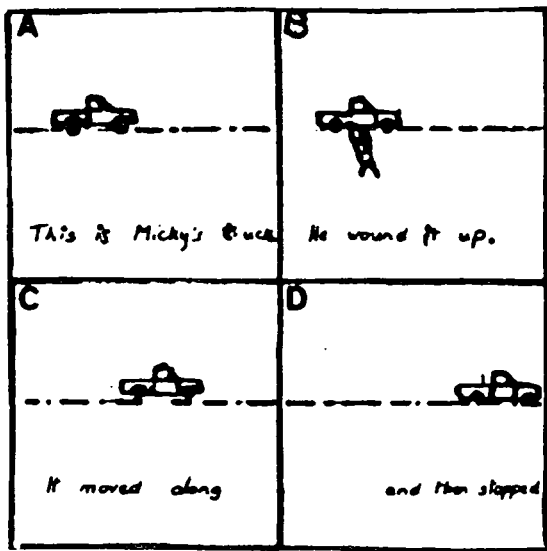
a) What would you expect to happen to the ammeter reading now ?
Tick in the box next to the one suggestion you would choose .

- ☐ A The ammeter reading will go up a bit
- ☐ B The ammeter reading will go down a bit
- ☐ C The ammeter reading will not change
- ☐ D The ammeter reading will go right down to 0.

b) Give the reasons for your choice :

.....
.....
.....
.....

Question 11: "Sources of Energy" (3A)



a) When did Micky's truck have the most energy?

Pick in the box next to the one you choose .

- ☐ A Before it was wound up
- ☐ B After it had been wound up
- ☐ C When it was moving along
- ☐ D When it had stopped
- ☐ E Same all the time

b) Give the reason for choosing the one you did .

Because

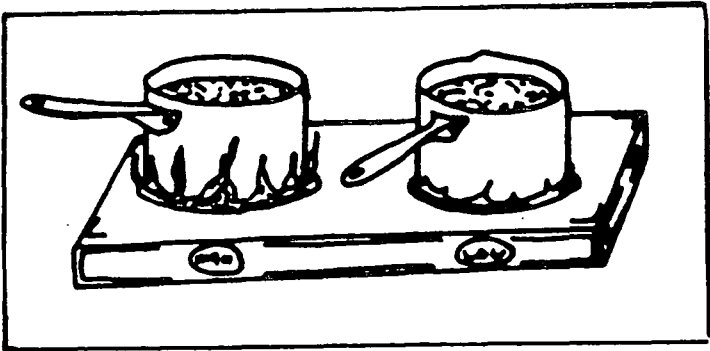
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Question 12: "Boiling Potatoes" (2 B)



A cook put two saucepans on a stove to boil. When they were both boiling she turned the gas under one down low so that the water was just kept boiling. She left the other on high. She thought the one on high would cook the potatoes faster. A friend said it would make no difference to the cooking time of the potatoes .

Which person do you think is right ?

.....

Give your reason :

.....

.....

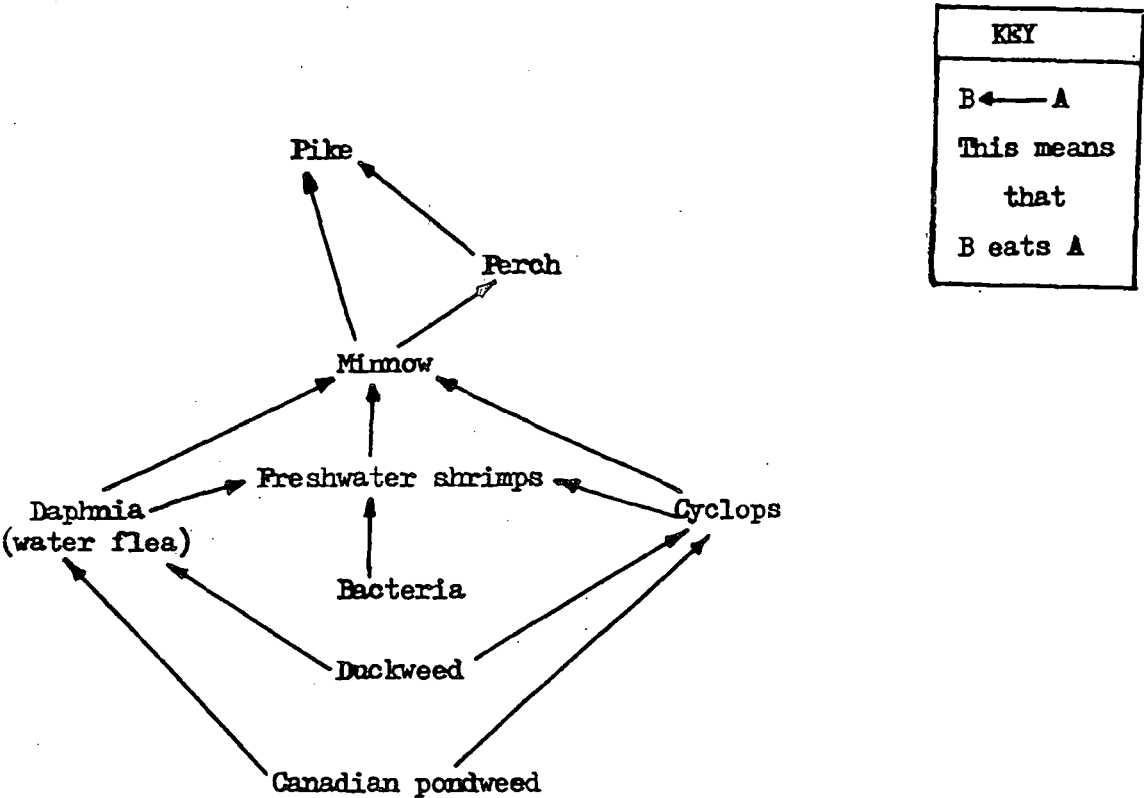
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Question 1: "Cyclops" (3B)

The diagram shows the way some animals and plants living in a canal depend on each other for food .



If there is a sudden drop in the number of Cyclops , what is likely to happen to the numbers of Daphnia (the water flea) ?

.....
.....

Give the reasons for your answer :

.....
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Question 3: "Onion Plant" (3A)

A gardener got all his seeds from one onion plant .

He planted half the seeds in a vegetable plot in the garden. He planted the other half in a greenhouse. He made certain that the seeds in the greenhouse were all treated in exactly the same way (that is, they all had the same amount of light and water, and they were planted in the same kind of soil). After 12 months the gardener dug up all the onions produced and weighed each one. The results he obtained are shown below :

ONION SIZE	Very small	Small	Medium	Large	Very large
GARDEN	7	10	83	9	8
GREENHOUSE	0	3	110	4	0

a) The seeds in the greenhouse were treated in exactly the same way and yet they produced different sized onions.

Can you explain why ?

.....
.....
.....

b) The onions in the garden varied more than the onions in the greenhouse (you can see this from the table).

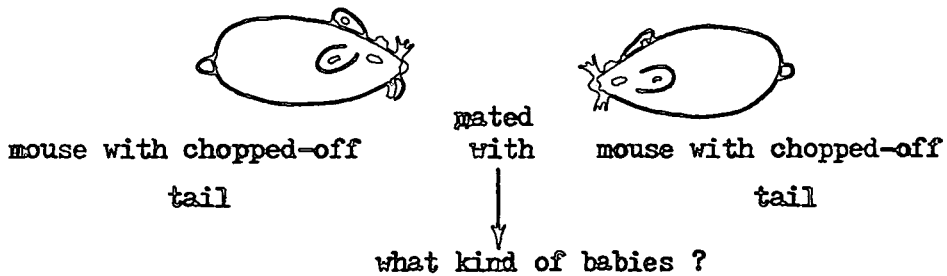
Can you explain why ?

.....
.....
.....

Question 5: "Mice" (3 B)

In an important historical experiment a scientist bred mice . In one litter he found that one of the baby mice had been born with no tail . When it was adult he mated this tailless mouse with a normal mouse and got some tailless babies in the litter . To see if he could get more tailless mice , he cut off the tails of some normal adult mice and bred them . When these mated , however , all their baby mice had tails .

a)



Do you think that if he bred the mice with the chopped-off tails again he would get tailless mice ? Explain your answer .

.....

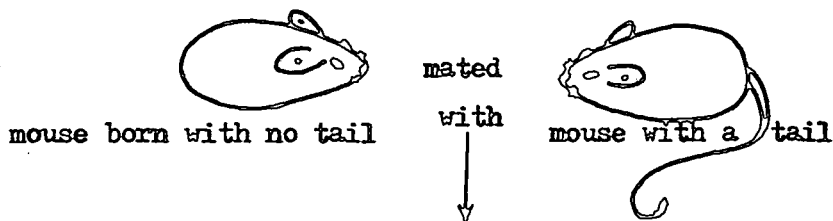
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b)



A litter with some baby mice with tails, and some without tails

Why was it that the mouse born with no tail produced some baby mice with no tails ?

.....

.....

.....

.....

Question 6: "Spider Plant" (3A)

A spider plant is able to reproduce in two ways :

Group 1 - by flowers and seeds

Group 2 - by producing runners (giving plantlets which root and separate from the parents)

Young plants formed by both methods were raised under identical conditions.

After 100 days each plant was weighed.

The results are shown below :

Group 1 : From flowers & seeds	Mean weight 36g	Range of weights 16 - 55g
Group 2 : From runners	Mean weight 41g	Range of weights 38 - 43g

Which of the following statements most fully explains the greater range of weights of plants in Group 1 than in Group 2 ?

(Tick one box.)

- ☐ A Group 1 plants were raised under a wider range of environments than plants in Group 2 .
- ☐ B All group 2 plants were heavier than group 1 plants after 100 days .
- ☐ C Group 2 plants contained some 'heavy' mutations , whereas group 1 plants did not .
- ☐ D Group 1 plants were formed by sexual reproduction , whereas group 2 plants were reproduced asexually .
- ☐ E Runners produce heavy and light plants in equal numbers .

Question 8: "Menstrual Cycle" (3 A)

A girl with regular menstrual cycles started to menstruate(began her "period ") on the 1st of March .

She stopped menstruating on the 6th of March .

Her next menstruation began on 29th March .

On which of the following dates do you think it is most likely she released an egg from one of her ovaries ?

(Tick one box.)

- ☐ A 1 - 6 March
- ☐ B 7 - 11 March
- ☐ C 12 - 16 March
- ☐ D 17 - 22 March
- ☐ E 23 - 28 March

Question 9: "Animal Eggs" (3 B)

Animal	Number of offspring every season	How young are produced	Amount of parental care
Fish	More than 10,000	Lay eggs without shells	None
Amphibian	More than 1,000	Lay eggs without shells	None
Reptile	More than 100	Lay eggs with shells	Very little
Bird	5 - 10	Lay eggs with shells	A lot
Mammal	1 - 5	Give birth	A lot

This table shows the number of offspring that a pair of animals belonging to these groups produce in one breeding season. (There are, of course, exceptions.)

Why does a fish lay so many more eggs than a reptile ?

Give two reasons using the information in the table above .

1
.....

2
.....

Question 10: "Sexual Reproduction" (3A)

Put a tick against each of the following in which you think sexual reproduction has taken place .

Put a cross against those in which it has not taken place .

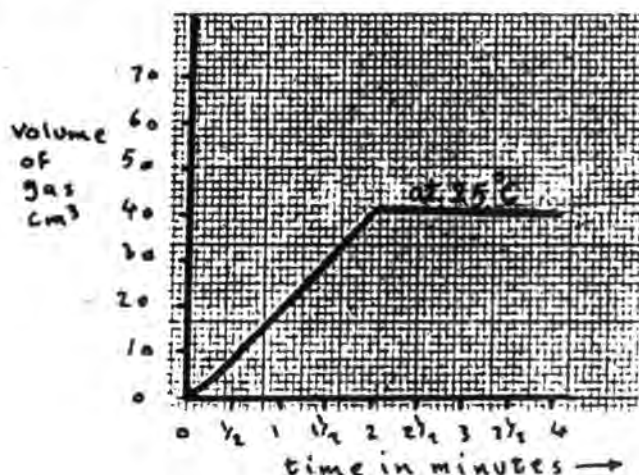
- ☐ A A ~~man~~ planted a hundred daffodil bulbs in his garden. Each spring he cut all the flowers while they were still in bud and sold them. After a few years, he dug over his garden and found that he now had over three hundred daffodil bulbs.
- ☐ B A doctor took an egg cell from a woman. He fertilised the egg in a test tube using sperm from the woman's husband. He put the fertilised egg in the woman's womb where it developed . Nine months later she had a baby .
- ☐ C A farmer placed some day - old female chicks in a cage on their own . After a few weeks , he put each chick in its own cage and fed them till they were fully grown. They all began to lay eggs.
- ☐ D sycamore tree grew in a park . Every spring , the gardener found a large number of sycamore seedlings growing in the grass around the tree .

Tests of Chemical Concepts for Age 15

Question 1: "Reaction Rate" (3A)

When an excess of solid was added to a solution at 25°C a gas was given off.

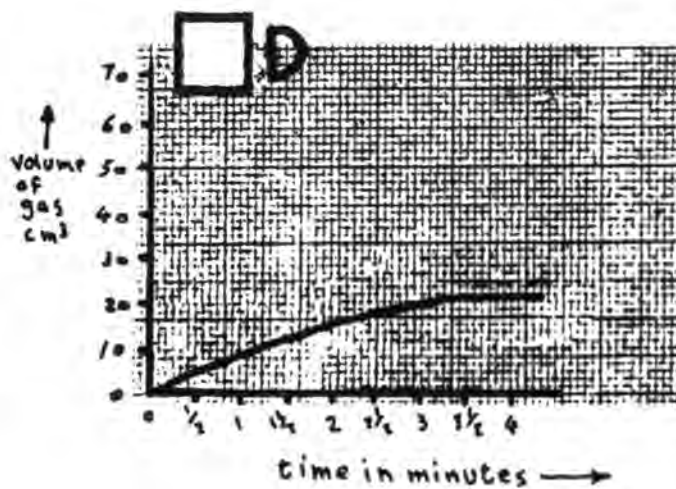
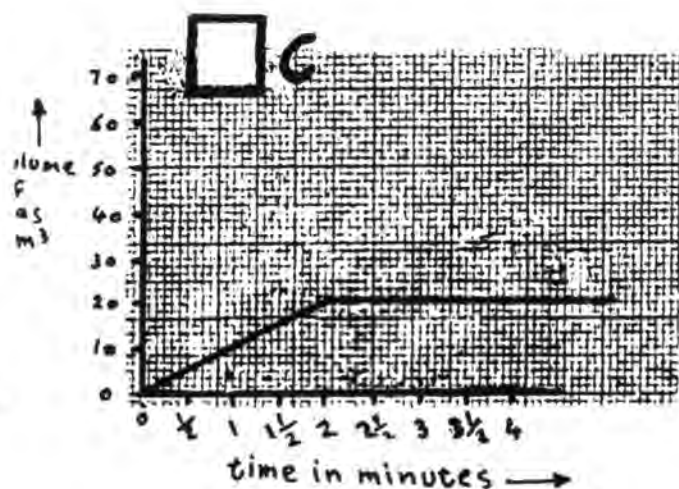
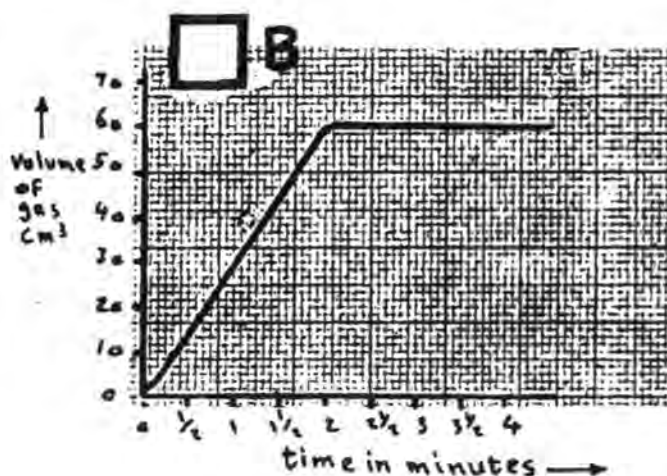
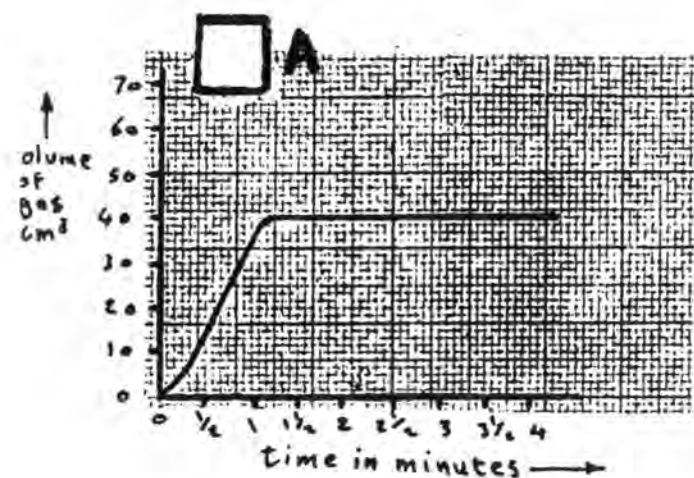
The volume of gas measured against time was plotted below:



The same experiment was repeated with the solution at 35°C .

Which one of the following graphs would you expect as a result?

(Tick one box)



Question 2: "Sodium" (3 B)

After many experiments , scientists now think that :

- ☐ all things are made from atoms
- ☐ atoms are made from a nucleus (containing protons) surrounded by electrons
- ☐ the number of electrons and protons in a neutral atom is always the same

Here is some information about the numbers of protons and electrons in three different atoms :

	Number of protons	Number of electrons
Neon	10	10
Sodium	11	11
Magnesium	12	12

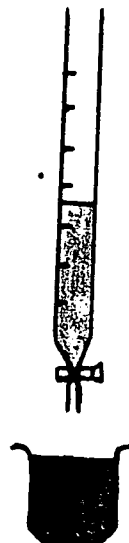
If one electron was taken away from a sodium atom , what would be left ?

(Tick one box.)

- ☐ A A neon atom
- ☐ B A negative neon ion
- ☐ C A positive magnesium ion
- ☐ D A positive sodium ion
- ☐ E A negative sodium ion

Question 5: "PH Graph" (2B)

A pupil has this apparatus :

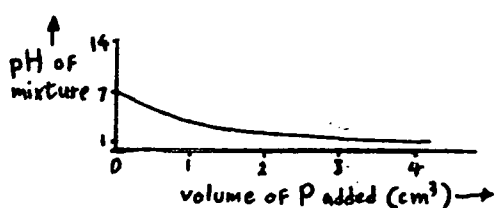


She measures the pH of Q

She adds P to Q 1 cm^3 at a time

after each addition she measures the pH of Q

This is a graph of her results :



What does the graph show the pupil was doing ?

Put a tick in the box by the one you choose .

- ☐ A Adding acid to alkali
- ☐ B Adding water to alkali
- ☐ C Adding acid to water
- ☐ D Adding alkali to water
- ☐ E Adding alkali to acid

Question 6: "Copper Pipes" (2B)

When a house was newly built both the hot and cold water pipes in the kitchen were shiny .

Before long , the outside of these pipes had ~~become~~ dull and tarnished (covered with a thin , dark layer) .

The outside of the hot water pipes was more tarnished than the outside of the cold water pipes .

a) What had caused the pipes to tarnish ?

.....
.....

b) Why do you think the hot water pipe is more tarnished than the cold water pipe ?

.....
.....

c) What substance do you think the tarnish is made of ?

.....
.....

Tests of Physical Concepts for Age 15

Question 2: "Energy Transfer" (3A)

Here is a list of jobs .

Some require the transfer of energy , some do not .

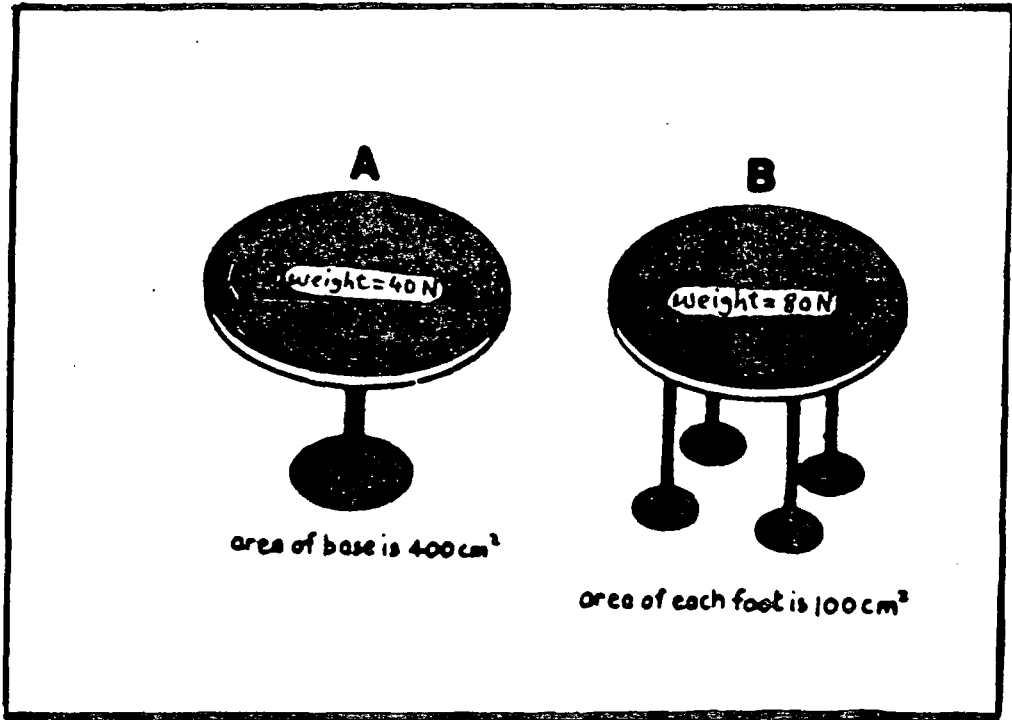
Put a tick by those where energy is transferred .

Put a cross by those where it is not .

(Put a tick or a cross in every box .)

- ☐ A A person pushes a drawing pin into a board
- ☐ B A shelf supports a row of books .
- ☐ C A person lifts a car using a car - jack
- ☐ D A crane lifts a load
- ☐ E A crane holds a load in position

Question 4: "Tables" (3A)



You may have noticed that some furniture flattens the carpet .

- a) Which of these tables will make the deepest impression on the same carpet ?

.....

- b) Give the reasons for your answer .

.....

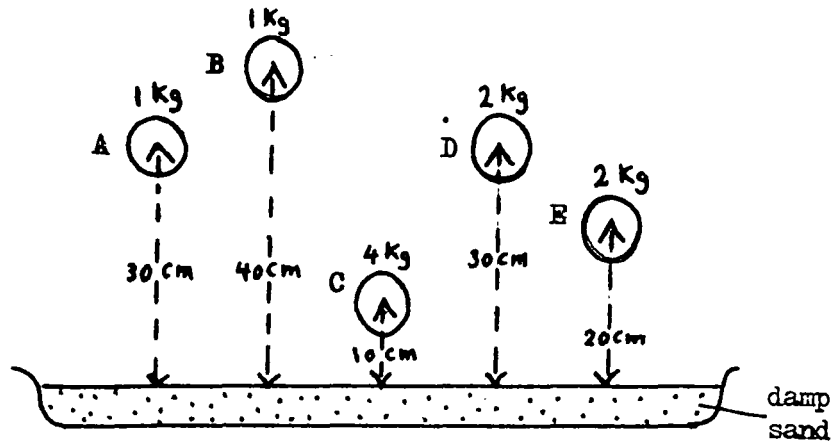
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Question 6: "Drop Sand" (3 B)



Five metal balls of equal size but different masses are dropped on to a tray of damp sand from the heights shown .

a) Which will make the deepest dent ?

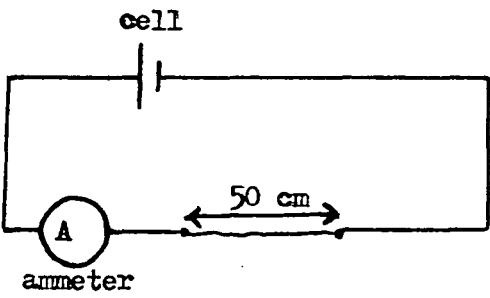
- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E

b) Which will make the shallowest dent ?

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E

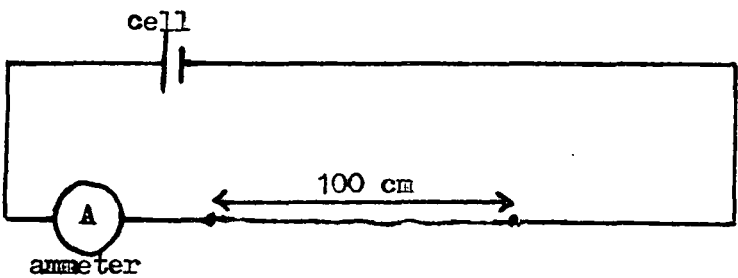
Question 8: "Current Electricity" (3B)

A pupil connected a 50 cm length of resistance wire between two crocodile clips in the circuit . He noted the current reading on the ammeter



The reading on the ammeter was 2A .

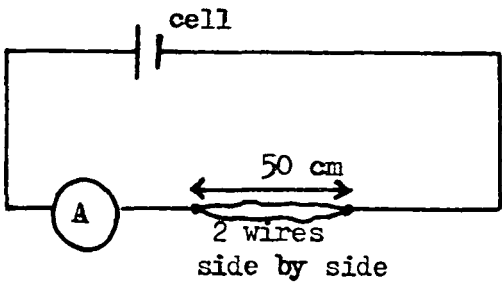
- a) What would the current in the circuit be if he used a 100 cm length of the same wire ?



Ammeter reading

Give the reason for your answer .
.....

- b) What would the current in the circuit be if he used two 50 cm lengths of the same wire side by side?



Ammeter reading

Give the reason for your answer.
.....

Question 9: "Plank" (3 B)

The pictures show a man raising a heavy roller from one level to another using a rope to pull it up different planks.

The statements below are about the amount of energy he uses in each case.

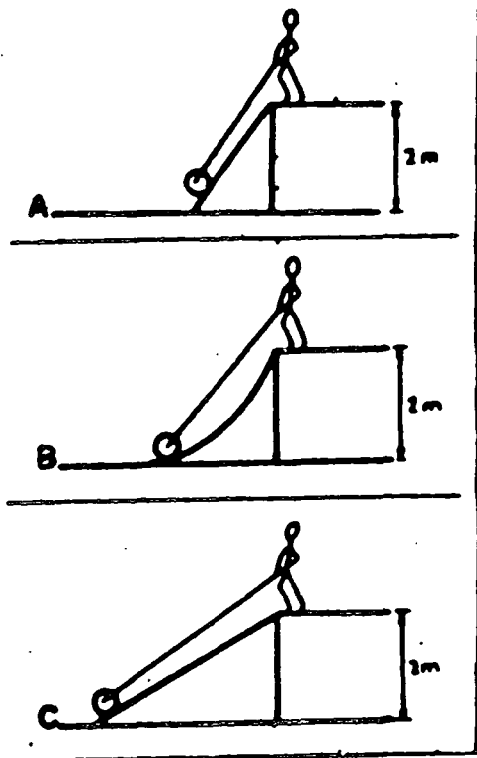
a) Put a tick in the box beside one statement you agree with .

☐ A The energy he uses to lift the roller on plank A is least .

☐ B The energy he uses to lift the roller on plank B is least .

☐ C The energy he uses to lift the roller on plank C is least .

☐ D The energy he uses to lift the roller is the same whichever plank is used .



b) Give the reason for your choice of answer.

.....
.....
.....

دراسة ميدانية

اختبار النمو المعرفي في العلوم العامة

للتلاميذ المصريين أعمار ١١ ١٢ ١٣ ١٤ ١٥ سنة

بمدارس اسوان و طنطا
لنيل درجة دكتوراه الفلسفة في علم النفس لتعليم

.....

اسم التلميذ :

الجنس : ولد ☐ بنت ☐

تاريخ الميلاد :

تاريخ الاختبار :

الصف الدراسي :

اعداد : سلوى محمد خليل
مدرسة التربية
جامعة درم - المملكة المتحدة

تعليمات الاختبار

عزیزی ... عزیزک ...

الاسئلة في هذا الاختبار تهدف الى التعرف على طريقة تفكيرك في معالجة المسائل العلمية. في بعض الاسئلة ستجد كل المعلومات المنفصلة التي تحتاجها في الحل ، وفي البعض الآخر عليك ان تستخدم بعض الأفكار التي قد تكون تعلمتها من المدرسة او من البيت .

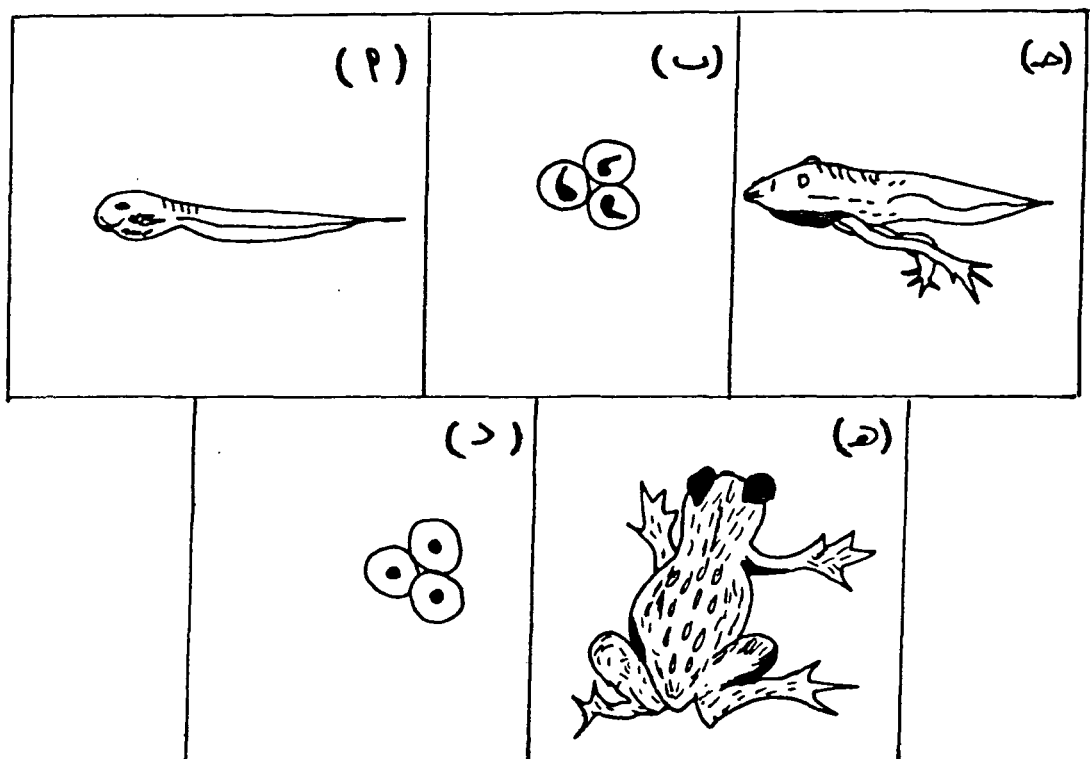
انذارك في غاية الاهمية لنا.. لذلك نرجوا ان تحاول جاهداً ان تحل كل سؤال حتى ولو كنت غير واثق من اجابته .

- ✧ اقرأ كل سؤال بدقة واهتمام .
- ✧ ارفع يدك اذا كنت تحتاج مساعدة بعض الاسئلة .
- ✧ كل سؤال في ورقة منفصلة ، وبعض الاسئلة تتطلب منك ان تضع علامة (ص) امام الاجابة الصحيحة وبعضها يتطلب منك ان تدور اجابته من الخلاء الخالي في ورقة السؤال .
- ✧ على قدر مستوى وطريقة تفكيرك حاول ان تجيب على كل الاسئلة وستجد الوقت الكافي للاجابة عليها جميعاً .
- ✧ نال الله ان تجد الاسئلة شيقة ومجدية باهتمامك .

اولا : اسئلة التاريخ الطبيعي
للعام ١١ ٤١٣ سنة

(١)

يبين الرسم التالي اطوار دورة حياة الضفدعة بغير انظام.



اكتب الحروف التي على الصور بالترتيب الذي تراه يوضع حدوث الاطوار
بالنظام الصحيح..

.....

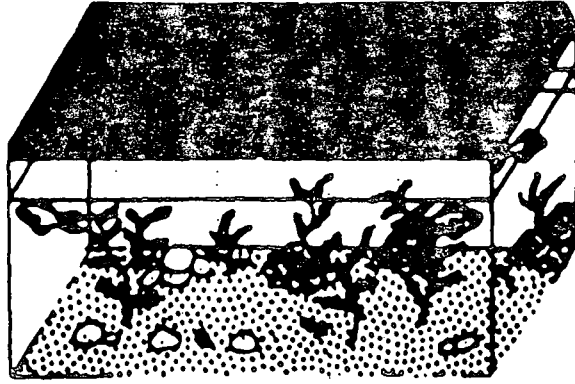
(٢)

السلسلة الغذائية توضح كيف انه الكائنات الحية المختلفة يعتمد بعضها على بعضها في الغذاء .

فاذا كانت العلامة ب → م تعني انه (ب) يأكل (م) - فضع علامة (س) امام السلسلة الغذائية التي تراها غير ممكنة الحدوث من بين السلاسل الغذائية الخمسة التالية :

- ١ ☐ ابيه عرس → الارنب → العشب
- ٢ ☐ البومة → السمكة → اليرقة → نبات عشب الغراب
- ٣ ☐ الضفدعة → الخنفاء → ديدان الارض
- ٤ ☐ ابو قردانه → الفراشة → زهرة البنفسج → البعوضة
- ٥ ☐ الانان → سمك القرموط → سمك البلطي → الجمبري → برغوث الماء

(٣)



عندما أضئ النور من حوض السمك قصت الاسماك وقتاً بالقرب من
سطح الحوض اطول من الوقت الذي قضته بالقرب من قاع الحوض .

فكر في سبب مختلفه لماذا فضلت الاسماك السباحة بالقرب من سطح الحوض ؟
اكتب السبب الاول امام (أ) والثاني امام (ب) .

(أ) اعتدائه هذا حدث لأنه

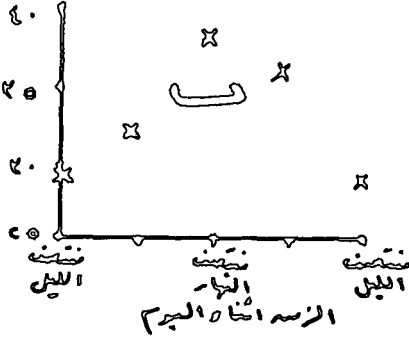
(ب) أو لأنه

(٤)

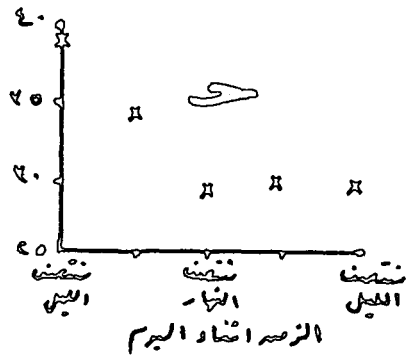
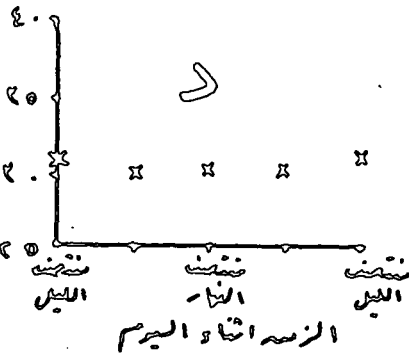
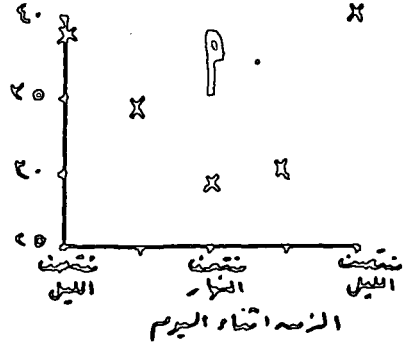
تركيز ثنائي أكسيد الكربون في الهواء (كمية ثنائي أكسيد الكربون بالنسبة المئوية) تم قياسها بواسطة مزرعة بالمشآت الطولية والآخر تم حرثه حديثاً. وكانت القياسات تؤخذ كل ٦ ساعات أثناء يوم واحد كامل.

الاشكال الآتية تبين نتائج هذه القياسات لكل المخططين:

كمية ثنائي أكسيد الكربون
بالنسبة المئوية



كمية ثنائي أكسيد الكربون
بالنسبة المئوية



(٢) أي هذه الاشكال (٢، ٣، ٤) أو ٥ يوضع تركيز ثنائي أكسيد الكربون في مزرعة المحصول المزروع بالمشآت الطولية؟ ضع علامة (س) امام الحزن الذي يشبه الشكل الذي تقارنه.

٢ ☐

٣ ☐

٤ ☐

٥ ☐

(٣) أي هذه الاشكال (٢، ٣، ٤) أو ٥ يوضع تركيز ثنائي أكسيد الكربون في مزرعة المحصول المحروث حديثاً؟ ضع علامة (س) امام الحزن الذي يشبه الشكل الذي تقارنه.

٢ ☐

٣ ☐

٤ ☐

٥ ☐

(٥)



٢- تخير اثنين من هذه الطيور تعتقد انها يأكلان نفس نوع الطعام .

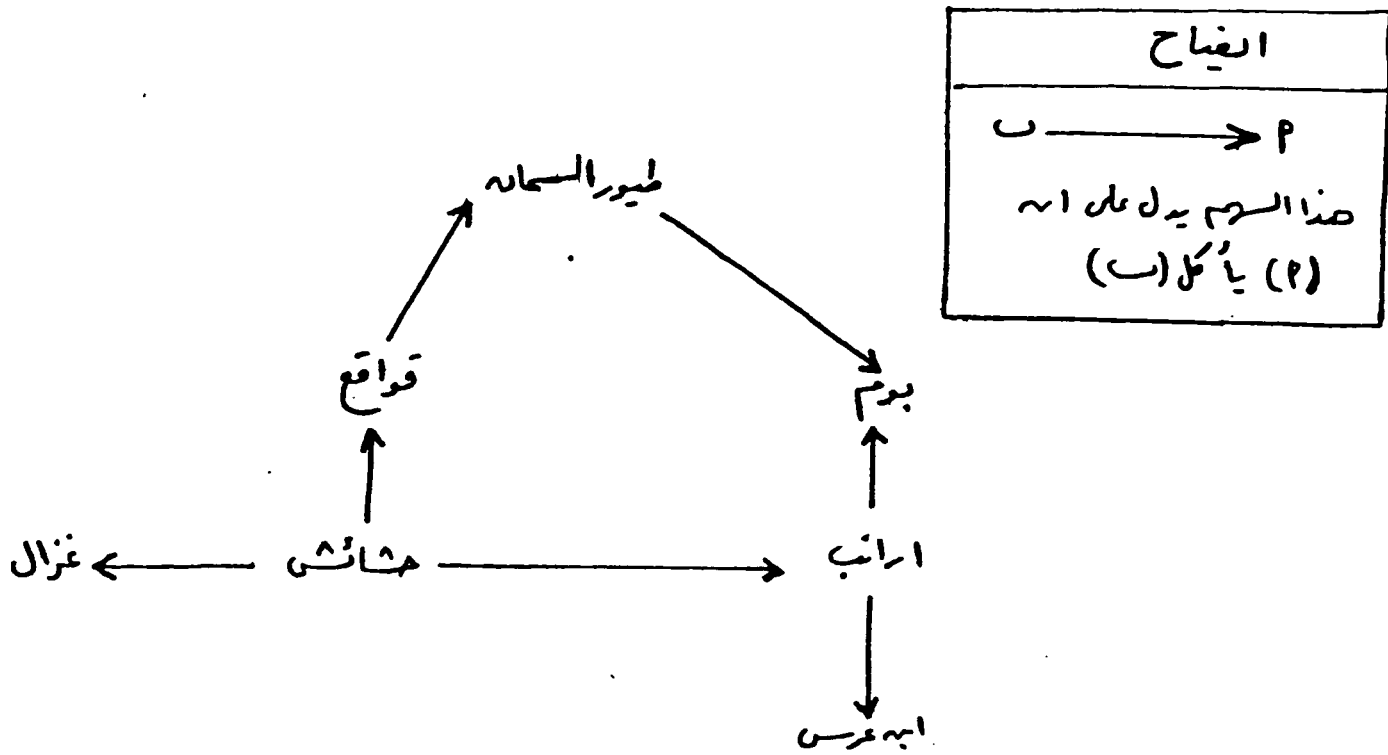
.....
.....

٣- لماذا تعتقد انها يأكلان نفس نوع الطعام (علل اختيارك) ؟

لأنه

.....
.....
.....
.....

(٦)



نأخذ الشكل السابق واستخدم الفيصاح المعطى من الإجابة على السؤال التالي.

(پ) إذا كان عدد الارانب يتزايد ، فأى المجموعات الاخرى تزداد نتيجة لذلك ؟

.....

.....

.....

(ب) إذا كان عدد الارانب يتزايد ، فأى المجموعات الاخرى تتناقص نتيجة لذلك ؟

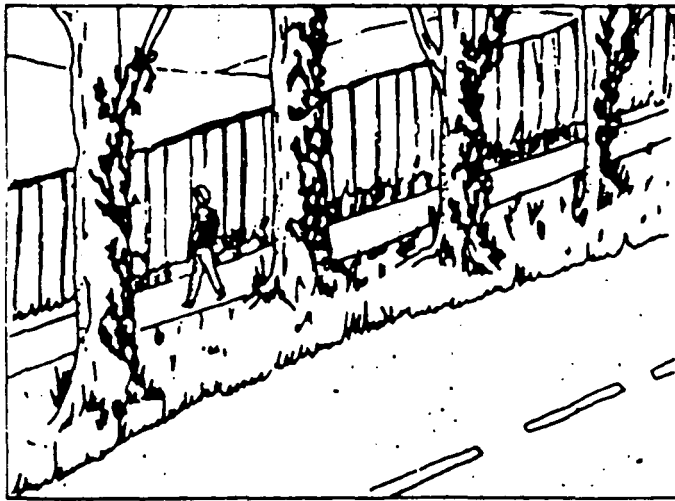
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(٧)

اثناء تجواله من هذا المحر لارسط "عادل" نحو اللبواب (نبات صله) على الاشجار
ولارسط ايضا انه اللبواب يغير ثمرة ارباع جذوع الاشجار فقط وانه لا ينمو على جانب
الاشجار المواجه للممر الذي يسير فيه.



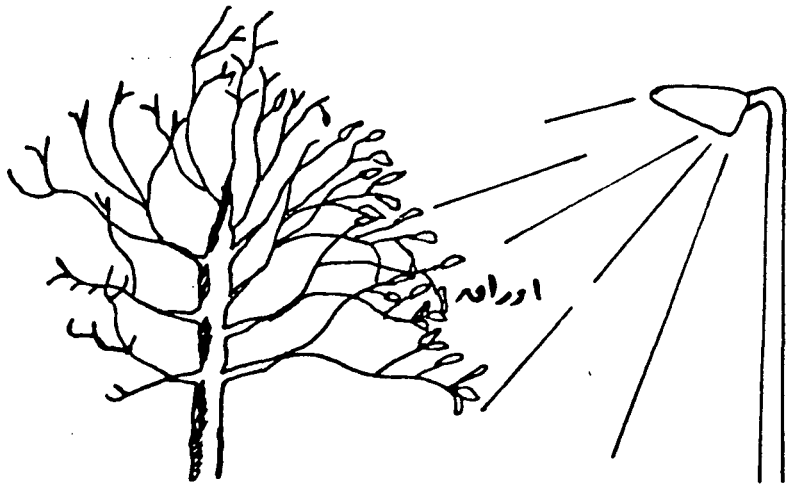
فكرت سببه تخليفيه تعلق بها لماذا يحور نبات اللبواب على بعض جوانب الاشجار
فقط ؟ ... آلت السبب الاول امام (أ) والثاني امام (ب).

أ - اعتقد انه هذا يحدث لك

ب - او لك

(٨)

استخدم المعلومات الآتية من الإجابة على السؤالين التاليين ..
 في بريطانيا في الصورة أمام شجرة بجانب صباغ لاجد المدة النور من الشارع من اواخر
 شهر أكتوبر. كانت الشجرة ممتلئة بالادواره خلال فصل الربيع والصيف ولكنه من
 فصل الخريف بدأت اوراقه تساقط ولم يبق منه الا الادواره التي تظهر في الصورة
 على جانب واحد من الشجرة .



- (١) ضع علامة (س) امام عبارة واحدة تعتقد ان السبب في سقوط الادواره من الشجرة؟
- | | | |
|--------------------------|----|--------------------------|
| <input type="checkbox"/> | أ | درجة الحرارة |
| <input type="checkbox"/> | ب | طول النهار |
| <input type="checkbox"/> | ج | الرطوبة |
| <input type="checkbox"/> | د | درجة الحرارة والرطوبة |
| <input type="checkbox"/> | هـ | درجة الحرارة وطول النهار |

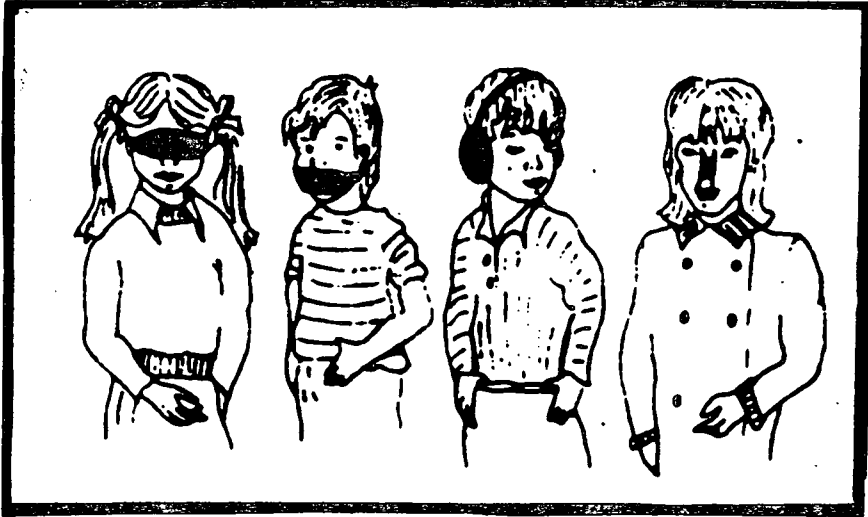
(٢) كيف تتوقع حالة الشجرة في شهر يناير؟

.....

.....

.....

(٩)



٥) تأمل الصورة جيداً ثم ضع علامة (ـ) امام اي شيء من الاشياء الآتية
يستطيع جميع الافراد من الصورة التعرف عليه وتكديده دونه استناد .

ما اذا كان المشروب شايًا ام قهوة ؟


☐

ما اذا كان لونه الزهراء برتقالي ام احمر ؟


☐

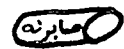
ما اذا كانت البقيرة ساخنة ام باردة ؟


☐

ما اذا كانت الساعة تدق ام لا ؟


☐

ما اذا كانت الصابونة لارائحة ام لا ؟


☐

٦) علل اختيارك للجواب .

لأن

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(١٠)

ابو النضيل (الجراد الاصفر) يجذب إنثاه باستخدام الصوت بينما
يجذب الطاووس إنثاه باستخدام اللون .

فكر في ثلاثة أسباب محتملة تعلق بها لماذا يستخدم ابو النضيل الصوت
ولا يستخدم اللون من اجل جذب أنثاه ؟

١-

٢-

٣-

(١١)

امامك في الرسم نوعا من نباتات عائش الاوز لـ كـ ن . احدها وجد ينمو في ارضه
بور والآخر ينمو في كل سراج من الشجيرات .



٢- اى من عائش الاوز لـ أـ رـ ن تتوقع انه ينمو

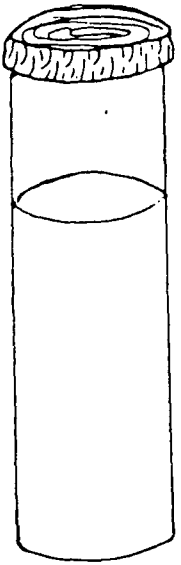
(١) في سراج من الشجيرات

(٢) في ارضه بور

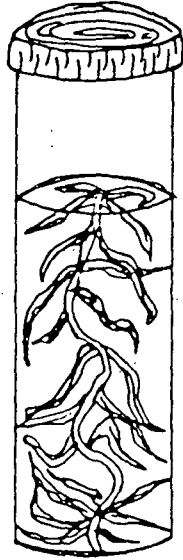
جـ - ما هو السبب اختيارك للجابة ؟

(١٢)

من الصباغ الباكر وضعت أربعة أوانٍ زجاجية محكمة السد كما يظهر في الشكل التالي



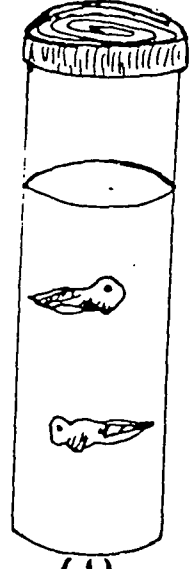
(٤)
ماء فقط



(٣)
نبات في الماء



(٢)
ابوزنبيقة ونبات في الماء



(١)
ابوزنبيقة في الماء

تركت الأوان بعد ذلك في مكان مضاء أضواء هبيرة لمدة ٨ ساعات. بعد هذه الفترة إذا
انقرصه انه الماء من انثائيه يحترق على نفس القدرة الأكسجينية وثاني أكسيد الكربون، فماذا
ماذا يحدث في كل الأوان ثم اذكر لماذا توافقه أو لا توافقه على هذه الفرضية ؟ ..

الاناء رقم (١)

الاناء رقم (٢)

الاناء رقم (٣)

الاناء رقم (٤)

لماذا توافقه أو لا توافقه على الفرضية السابقة ؟

يبين الرسم أمامك هاتين صلاتين من الرّيف الإنجليزي احداهما تم حرثه حديثاً
والآخر منظر بالثأث. بعد عاصفة جليدية لاحظت سارة "انه الجليد على
الحقل المغطى بالثأث أكثر منه الجليد على الحقل المحروث حديثاً .



فكر في سبب اختلافهما لماذا شاهدت سارة "كمية من الجليد على الحقل
المغطى بالثأث أكثر منه تلك على الحقل المحروث حديثاً ؟
آلتي السبب الأول (أ) والثاني (ب)

(أ) فذلك لأنه

.

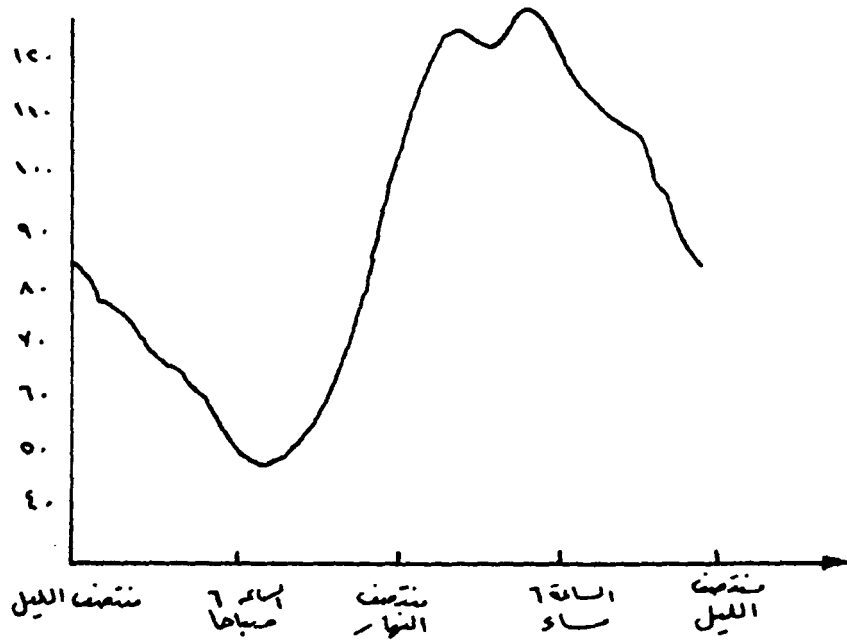
(ب) أو لأنه

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(١٤)

كمية الأكسجين المذاب في مجرى ماء تغيرها النباتات والحيوانات التي تعيش فيه .
 هذا الرسم البياني يبين التغير في كمية الأكسجين المذاب في مجرى ماء أثناء يوم واحد كامل :

النسبة المئوية للأكسجين المذاب



٥) لماذا تتناقص بسرعة كمية الأكسجين في المجرى المائي في الفترة من الساعة ٦ مساءً حتى الساعة ٦ صباحاً ؟

.....

.....

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٦) لماذا تتزايد كمية الأكسجين في المجرى المائي بعد الساعة ٦ صباحاً ؟

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ۛ) اذ اكانت مفعولة من بلد استوائ تجيز بفصليه مطريه و آفريه جانيه كل عام ؟

66

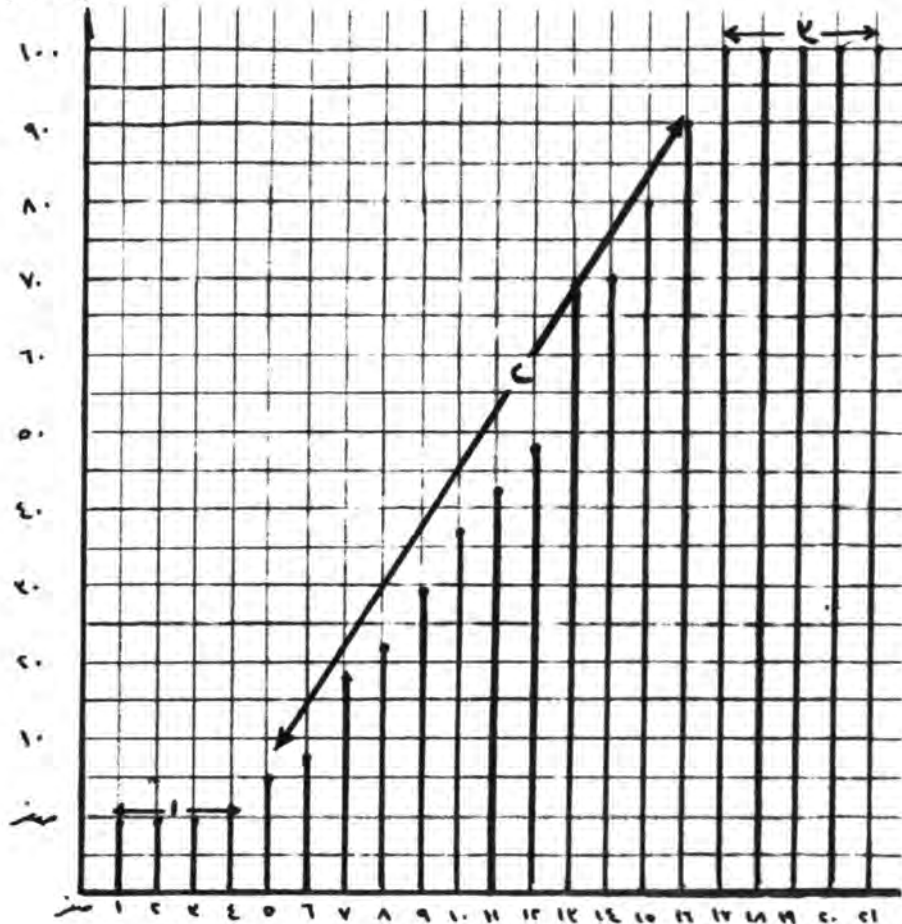
کیف حدوت عمره من الحالیہ ؟

ثانياً : السئلة الكيمياء
للعام ١١ ١٣٨١ سنة

(١)

قيست درجة حرارة الماء في كوب مأخوذه الشلاصة وكان الماء على شكل قطع مكسورة
من الثلج . بعد ذلك كانت تقاس درجة حرارة الماء كل دقيقة أثناء تسخينه .
الرسم البيان الآتي يبين نتائج هذه التجربة :

درجة الحرارة بالنسبة لمئوية



الزمن بالدقائق

لاحظ انه هذا الرسم البيان يقسم الى ثلاثة اجزاء ١ ٢ ٣ .
اجب عن الاسئلة الآتية - عندما اى من الكلمات التالية وعلية لك استخدام اللمسة
كلمة واحدة من اجابة كل سؤال :

ثلج - ماء - بخار

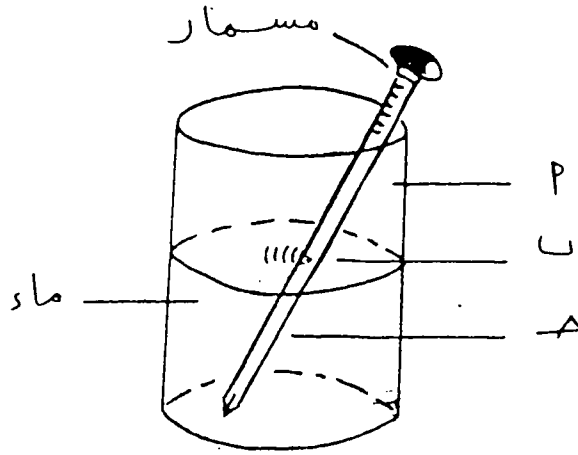
(أ) ماذا ترى من الكوب من خلال الجزء (١) من الرسم البيان ؟

(ب) ماذا ترى من الكوب من خلال الجزء (٢) من الرسم البيان ؟

(ج) ماذا ترى من الكوب من خلال الجزء (٣) من الرسم البيان ؟

(٢)

وضع مسمار مهقول لاعم لعدة أيام في كأس به ماء حتى منشفة
كما يظهر في الشكل امامك .



(عند أى نقطة من المسمار تعتقد أن معظمها سيصاب بالصدأ أكثر من غيرها؟
ضع علامة (✓) امام النقطة التي تعتقد ان صحيحة .

- | | |
|-----------------------|--------------------------|
| عند النقطة (P) | <input type="checkbox"/> |
| عند النقطة (B) | <input type="checkbox"/> |
| عند النقطة (A) | <input type="checkbox"/> |
| المسمار كله مرة واحدة | <input type="checkbox"/> |

ج علل سبب اختيارك لاجابتك .

(٣)

قامت اصد التلميذات باجراء بحث على عدة عناصر مختلفة (مصادره ونيرطاده) .
 خلال البحث قامت بتسنيده كل عنصر على ورقة غير قابلة للوشعال وكانت
 وكانت تقسيم كتلة كل عنصر قبل وبعده التسنيده
 الجدرل الدتت يبييه الشايج الدتت دوتتتت :

العنصر	الكتلة قبل التسنيده	الكتلة بعد التسنيده
حديد	٢ هـم	٢,٠٣ هـم
كربون	٢ هـم	٢,٠ هـم
كبريت	٢ هـم	صفر هـم
الوضيوع	٢ هـم	٢,٠٢ هـم
نحاس	٢ هـم	٢,٠٣ هـم
ايوربي	٢ هـم	٢,٠٣ هـم
منجنيز	٢ هـم	٢,٨٣ هـم

٢ اذافات التلمذه بتسنيده عنصر الزنك فاذا اجدت للكتلة هذا العنصر؟

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٣ كيف توصلت الى هذه النتيجه (علل اجابتي) ؟

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(٤)

— خنت اربعة مركبات (س، ص، ل، ن) على لب هادي في
 انابيب اختبار منفصلة .

المجدول التالي يبين التغيرات التي لوحظت :

المركب	اللون قبل التسخين	اللون وهو ساخن	اللون عند التبريد	التغير في اللوحة
س	سحرة ابيضه	سحرة اصفر	سحرة ابيضه	لا يوجد
ص	سحرة بني	سحرة بني	سحرة بني	لا يوجد
ل	بلورات بيضاء	بلورات بيضاء	بلورات بيضاء	لا يوجد
ن	سحرة اخضر	سحرة اسود	سحرة اسود	فقدانه

٢٠ ما المركب الذي تغير عنه التسخين ولكنه عاد الى حالته الاولى عند التبريد ؟

- ☐ أ - المركب س
☐ ب - المركب ص
☐ ج - المركب ل
☐ د - المركب ن

٢١ ما المركب الذي تفاعل بالتسخين ؟

- ☐ أ - المركب س
☐ ب - المركب ص
☐ ج - المركب ل
☐ د - المركب ن

الغصم والبترول وقوداته هفريانه من بريطانيا .

الغصم وقود صلب والبترول وقود سائل .

اكتشفت في الارض تراكبات طبيعية لهذه الوقوديه وعليه فانه يجب
انه يتم استخراجها من تحت الارض ثم نقلها بعد ذلك .

فكرت ثلاثة اسباب محتملة لماذا يكون استخراج الوقود السائل مثل البترول
من تحت الارض اسهل من استخراج الغصم ؟

(١)

(٢)

(٣)

(٦)

حاول احد التلاميذ ان يغير من درجة الحاصية من مقدار ١٠٠ سم
 حمص الفيتريك وذلك باضافة شئ ما اليه .

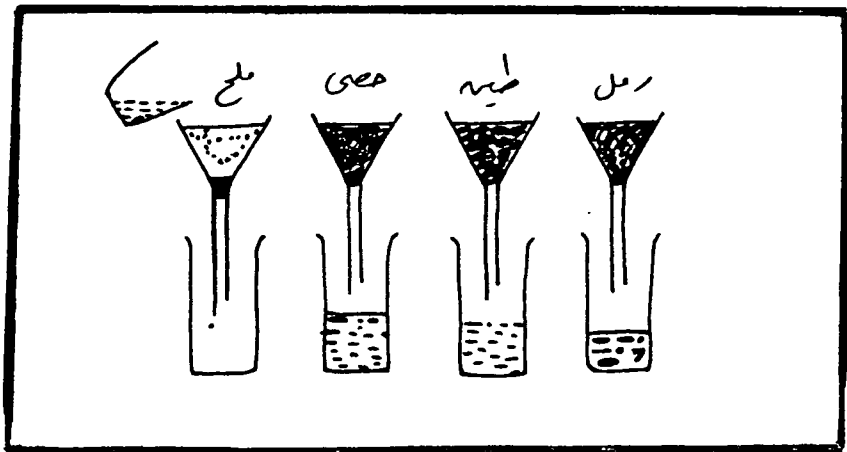
اى واحد من الاضافات المقترمة الآتية لا يغير من الحاصية ؟

ضع علامة (٤) امام الاضافة المقترمة التى تختارها

- ☐ ٢- ٥ سم من ماء الكالسيوم
- ☐ ٣- ١٠ سم من نفس حمص الفيتريك
- ☐ ٤- ٥ سم من ماء المغنسيوم
- ☐ ٥- ١٠ سم من قلوئى
- ☐ ٦- ١٠ سم من الماء الصان

(٧)

وَضَعْ نَبِيلَ وَخَالِدٍ أَرْبَعَةَ مَقَارِيرَ مَسَارِيَةٍ مِنَ الرَّمْلِ وَالْحَبِّ وَالْحَصَى وَالْمَلْحَ
 فِي أَرْبَعَةِ أَقْمَعَةٍ لَكِنِّ لِيَعْرِفَا مَقْدَارَ الْمَاءِ الَّذِي يَتَشَرَّبُهُ كُلُّ مِمَّا هَذِهِ الْمَوَادِّ
 وَلِذَلِكَ قَامَا لِيَسْبِ ... أَمَّا مِنَ الْمَاءِ مِنْ كُلِّ قَمْعٍ كَمَا يَفْهَرُ فِي الشَّكْلِ .
 نَجَحَتْ الْجَرَبَةُ مِنَ التَّلَوُّنَةِ أَقْمَعَةُ الْوَدِيِّ وَلَكِنَّهُ عَنْهُ صَبَّ الْمَاءُ مِنَ الصَّبْعِ الَّذِي
 بِهِ الْمَلْحُ أَضْفَرُ مَقْفَلِ الْمَلْحِ تَقْرِيْبًا .



لِمَاذَا تَعْتَقِدُ أَنَّ الْمَلْحَ أَضْفَرُ بَيْنَمَا الْمَوَادِّ الْآخَرُونَ بَقِيَتْ ؟

أَعْتَقِدُ أَنَّهُ ذَلِكَ تَدْعِدُنِي لِأَنَّهُ

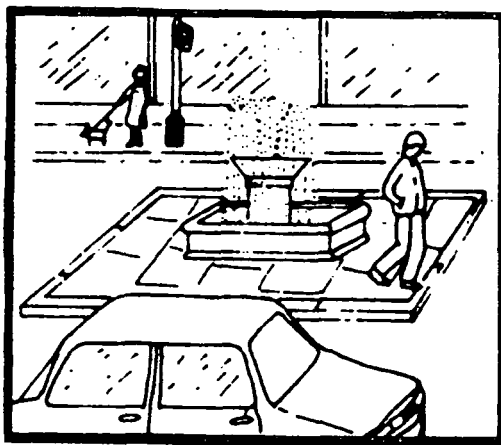
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(٨)

تم بناء نافورة من الرخام الأملس في وسط المدينة .



بعد عدة سنوات تآكل سطح الرخام وانتشرت به ثقوب صغيرة .

أذكر ثلاثة أسباب - ليس بينها ما يفضله الناس من أضرار بالنافورة - لعنفد
أنها احدثت الثقوب الصغيرة بالرخام .

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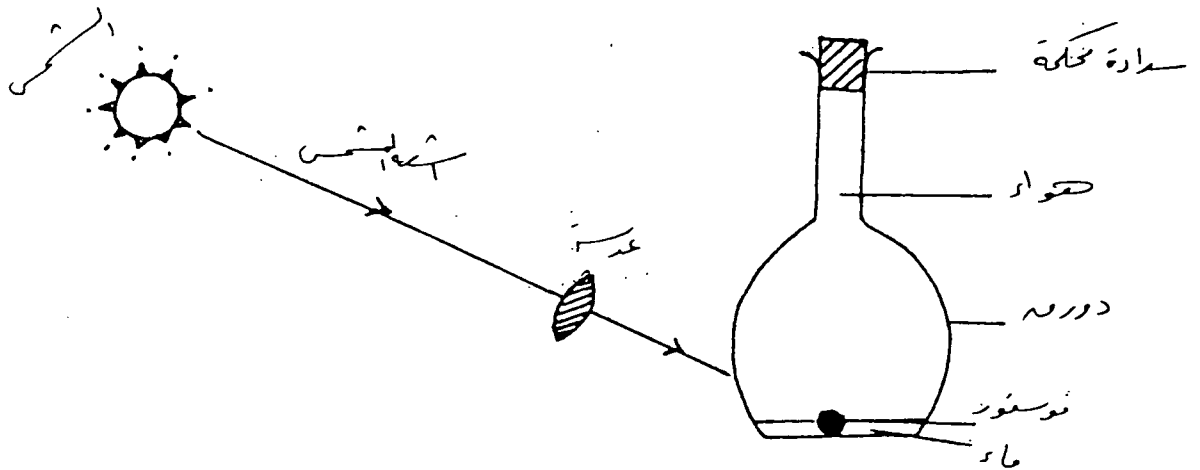
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٣-

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(٩)



وضعت قطعة من الفوسفور في دورن به قليل من الماء كما يظهر في الشكل وكان وزن الدورن وما يحتويه يساوي ٢٠٥ جم. ثم تركيز أشعة الشمس على الفوسفور فاشتعل دخان الدخان الأبيض الناتج بيلغ من الماء. وبعد التبريد تم وزن الدورن وما يحتويه مرة أخرى.

٥) حل لتوقع انه الوزن يكون :

أ - أكثر من ٢٠٥ جم ☐

ب - ٢٠٥ جم ☐

ج - أقل من ٢٠٥ جم ☐

د - اوانه ليست هناك معلومات كافية للإجابة. ☐

ضع علامة (س) أمام الإجابة التي تفقد الأنصبة.

٦) علل اختيارك للإجابة.

(١٠)

النشاط الكيميائي (التفاعل) لاربعة معادن معروفة يظهر بالترتيب الآتي :

أشد نشاطاً كيميائياً	—	زنك
	—	حديد
	—	رصاص
أقل نشاطاً كيميائياً	—	نحاس

طلب من تلميذ أنه يقوم بتسوية كيميائية قليلة تمثل خليطاً من كل من :

- ٢- برادة الحديد والأكسيد النحاسي
- ٣- برادة الحديد والأكسيد الرصاصي
- ٤- برادة الحديد والأكسيد الزنكي

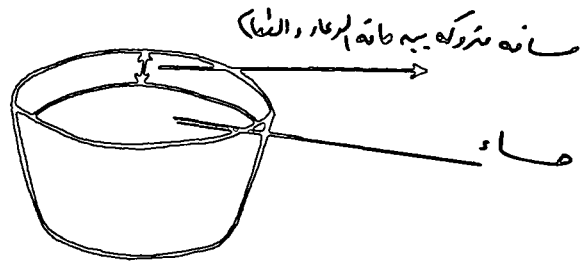
ماذا سيحدث في كل تجربة من التجارب الثلاث ؟

- ٢-
- ٣-
- ٤-

تالفا: السعة الضخمة
لدمار ١١ و ١٣ سنة

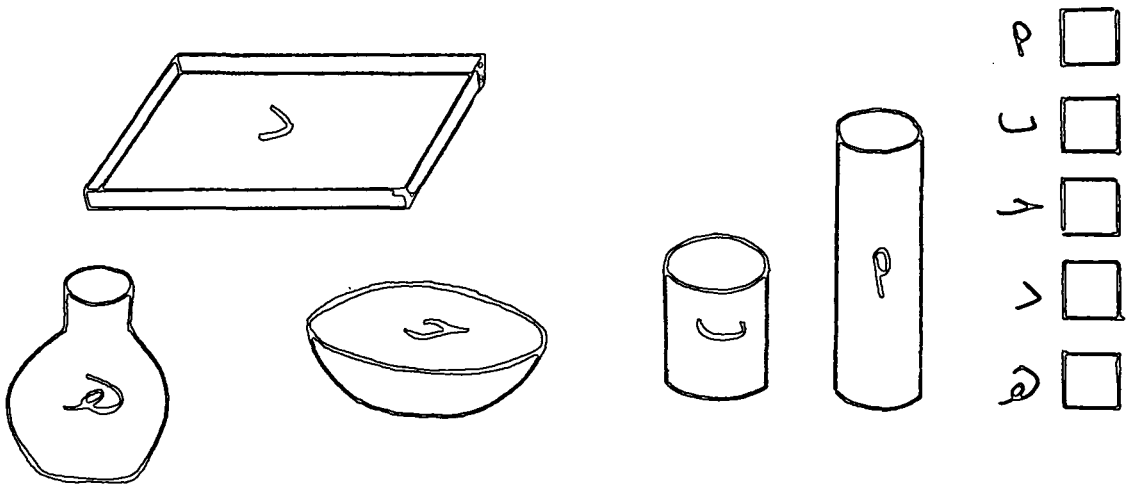
(١)

عندما نريد ان نضع سائل أو صلب أو طعاماً طويلاً في الشجرة لكن
نيجد نضعها البصم بانه نترك صفة فارغة عنه صفة الوعاء .



إذا كانت الوردية الآتية يمكنه ان نضع نفس كمية السائل ما في واحد
منها يمكنه ان يملأه بالسائل الى اقرب ما يمكنه من الصفة .

ضع علامة (س) أمام الحزن الذي يشير الى الوعاء الذي نختاره .



علل اختيارك للوعاء .

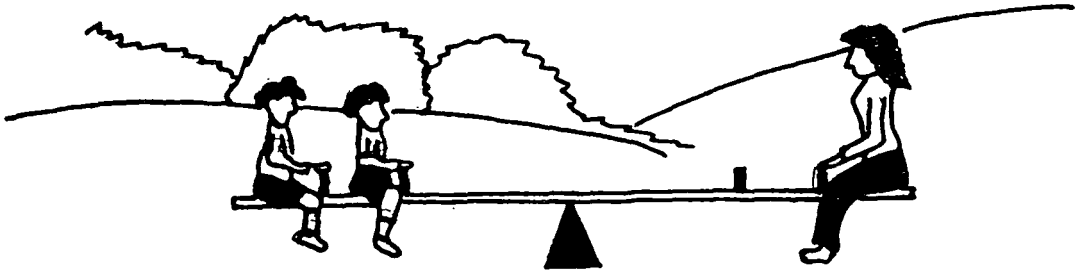
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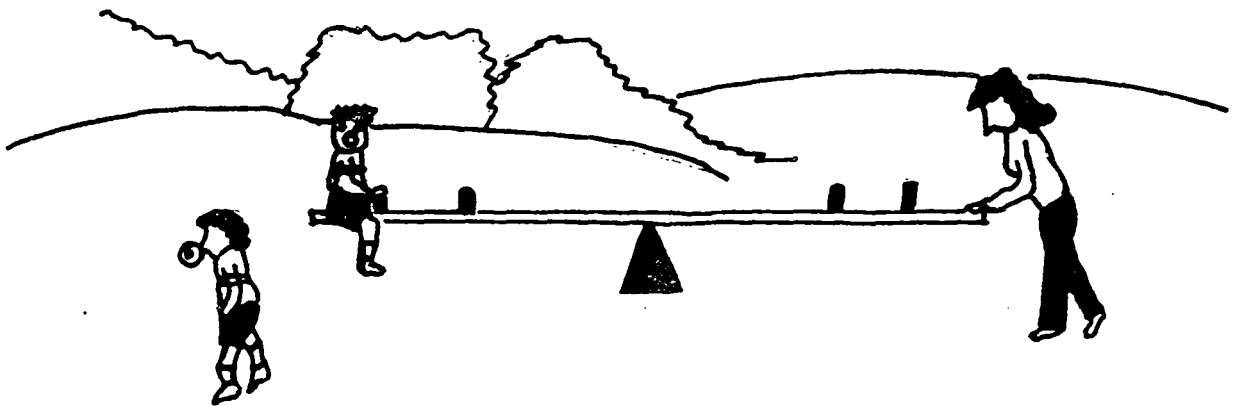
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(٢)

٣ دولاهما التوأمانه يتأرجحه على ارجوحة محورية



تنزل احد التوأمنه من الارجوحة



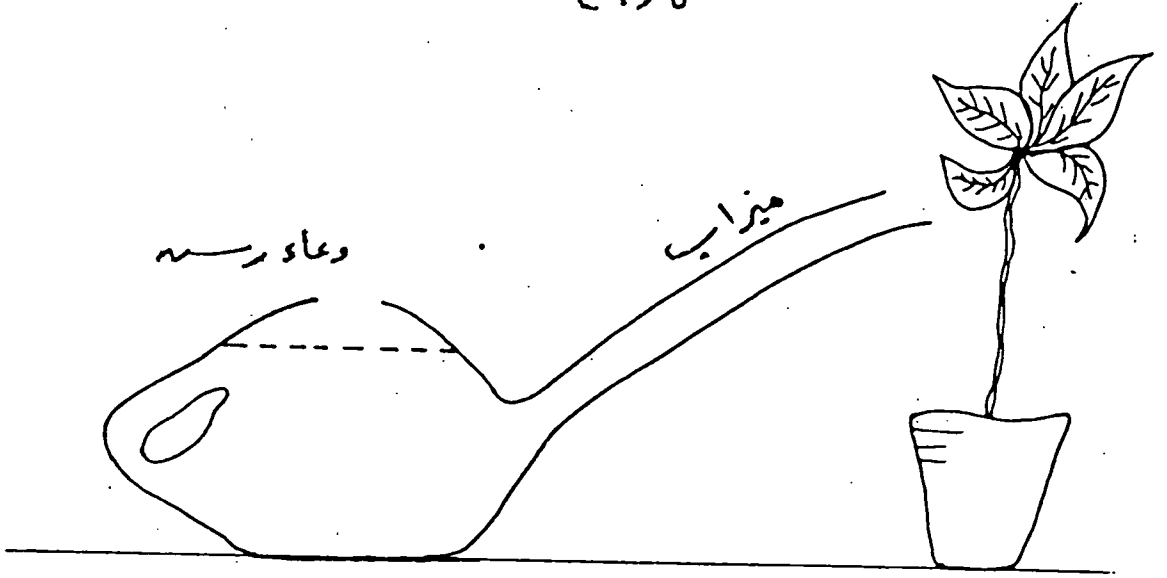
تريد الأم انه تتوازى من الارجوحة مع التوأمن الآخر .
فأيهم يجب انه تجلس ؟

ضع علامة (ـ) امام الاجابة التي تتفق معها أكثر .

- ١ - عنه طرف الارجوحة بالصنط ☐
- ب - البعد قليلا من طرف الارجوحة الى الامل ☐
- ج - من نصف المائدة بين طرف وشقفت الارجوحة . ☐
- د - موصلة تماما لشقفت الارجوحة . ☐

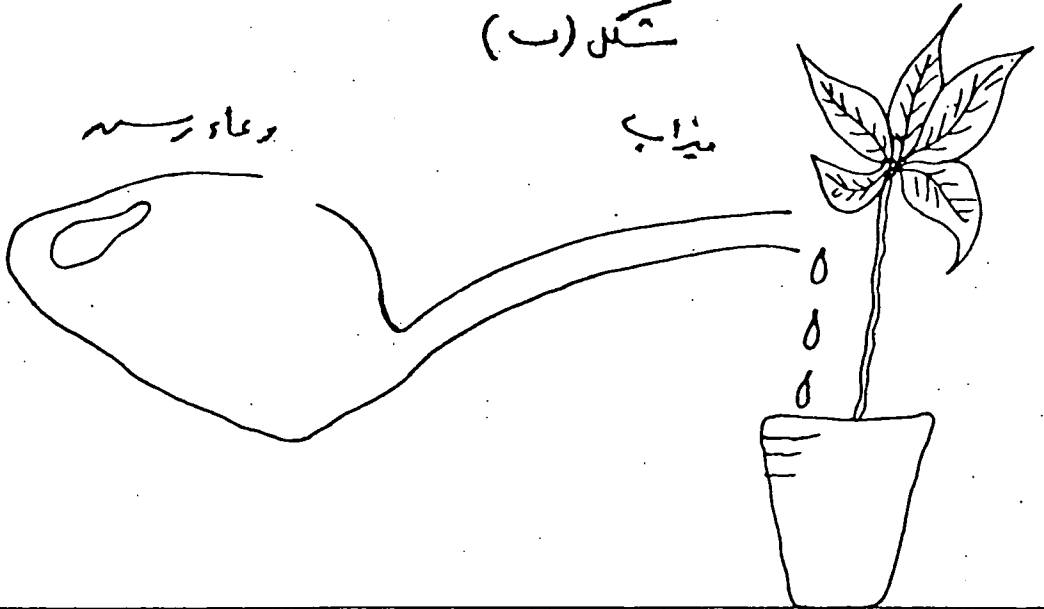
(٣)

شكل (٢)



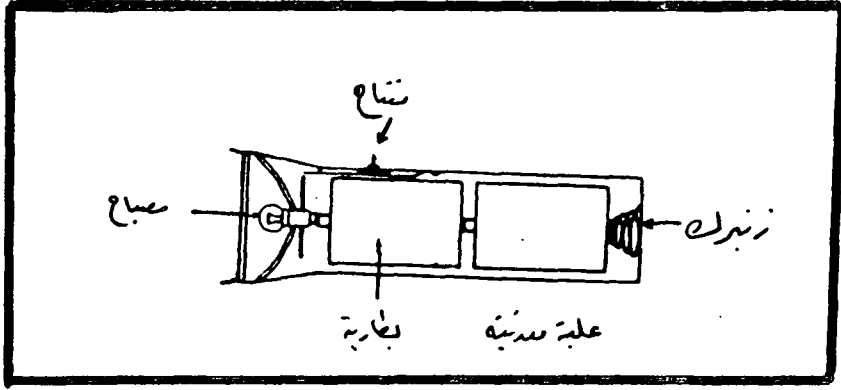
يشير الخط المنقط في الشكل (٢) الى مستوى سطح الماء في وعاء الرسه .
ارسم خطاً منقطاً يوضح ايده يكونه سطح الماء في الميزاب ؟

شكل (ب)



في الشكل (ب) يجيل وعاء الرسه لدرجة انه الماء به أبيضه الميزاب .
ارسم خطاً منقطاً يوضح سطح الماء في كلامه الميزاب والوعاء ؟

(٤)



في الرسم اعالج كشف كده بائس به الداخل .
وجد احمد هذا الكشف لا يعمل والكشف انه الزنبرك من قاع الكشف
مظن تماما بالهدأ . بعد تنظيفه وازالة الصدأ حتى ظهر المعدنه اللامع للزنبرك
وجد احمد الكشف يعمل .

لماذا تسبب تنظيف الزنبرك من تشييل الكشف ؟

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(٥)

- إنه جميع المواد تتكون من جزيئات دقيقة .
 هذه النظرية العلمية تنص على أن :
 - هذه الجزيئات تتحرك في كل الاتجاهات .
 - كلما زادت سرعة حركة الجزيئات كلما ارتفعت درجة حرارتها .
 - توجد قوى تجاذب متبادلة بين هذه الجزيئات .
 - هذه الجزيئات أصغر من أن ترى بالميكروسكوب .
 - تختلف أحجام هذه الجزيئات تبعاً لاختلاف المواد .

اجب عن السؤال التالي متعينا بأى من الأفكار السابقة .

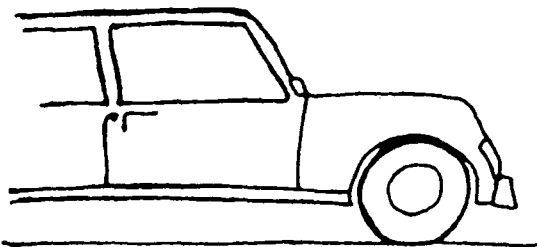
لماذا يزداد الضغط داخل إطارات السيارات أثناء السير ؟

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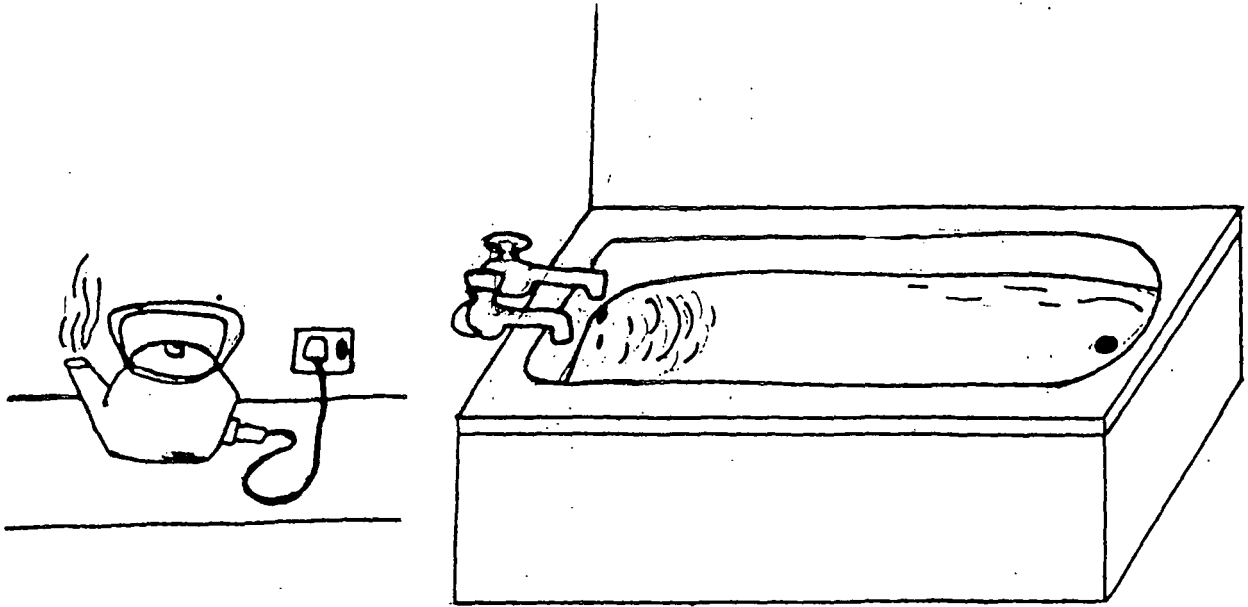
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(٧)

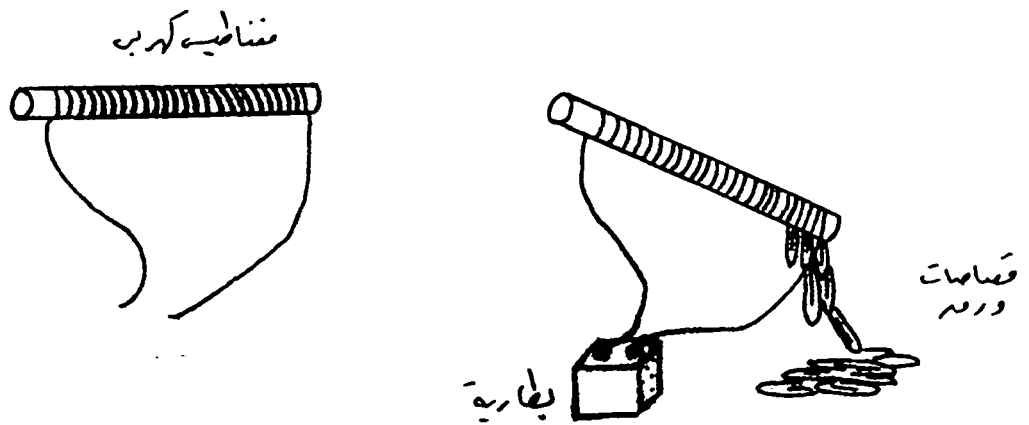


- ملئت بخلاية شاي كهربائية بالماء ووضعت للغليان .
 - وملئ جوصه استحمام (بانيو) بالماء حتى المستوى الموضح بالشكل وكانت درجة حرارة الماء أعلى قليلاً من درجة حرارة الجسم .
- ٥) إذا سخن الماء في كل من الخلاية والجوصه بالكهرباء ، فأيهما يكلف أكثر حتى يسخن ؟

ب) علل اختيارك لأحدهما

(٨)

قامت ناهد بوضع مغناطيس كهربيا وذلك بلف قطعة من السلك حول شئ طويل ورقيق ، ثم قامت بتوصيل طرفي السلك ببطارية . ثم اظهرت لاصيها الصغير " احمد " كيف انه المغناطيس يلتقط كثيراً من قصاصات الورق الموضوعة على الطاولة .



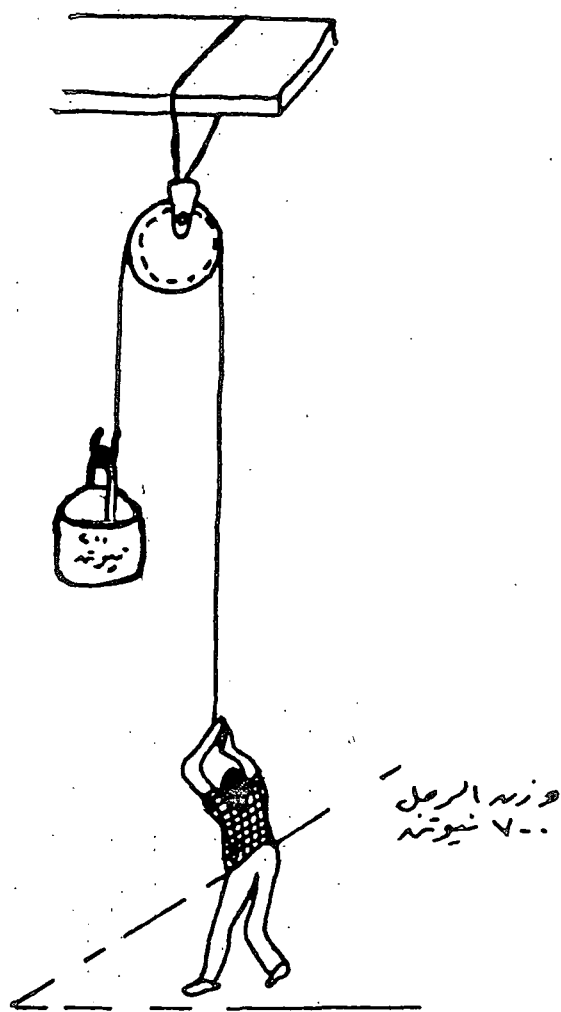
ذهب اخوها احمد وحاول انه يسبق لنفسه مغناطيس مثل مغناطيس اخيه . ولكنه مغناطيس احمد لم يعمل بنفس كفارة مغناطيس اخيه تقريباً . فذكر في ثلاثة اسباب تفريغ عدم كفاءة مغناطيس احمد وعمله بطريقة سيئة .

١-

٢-

٣-

(٩)

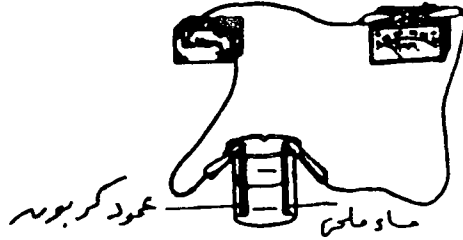


في موقع للبناء رفع رجل دلوًا مـه الا سحبت كما يظهر في الشكل
كم نيوتن تتوقع انه تساوي قوة قدم الرجل على الارضه ؟

ضع غيره (س) امام الاجابة التي تختارها.

- | | | |
|--------------------------|-----|-----------|
| <input type="checkbox"/> | ٢- | ١٠٠ نيوتن |
| <input type="checkbox"/> | ب- | ٢٠٠ نيوتن |
| <input type="checkbox"/> | ٥- | ٢٠٠ نيوتن |
| <input type="checkbox"/> | د- | ٥٠٠ نيوتن |
| <input type="checkbox"/> | هـ- | ٧٠٠ نيوتن |

(١٠)



قام "مجدى" بتصميم الدائرة التي تظهر أمامك في الشكل . وعندما قرأ
الاميتر وجدته عند ٢.٠ أمبير فاضاف ملعقة منه الملح الى الماء الملحي
وقلبيها لتزداد دونه انه يلمس المحدة الكربون .

- ② ماذا تتوقع انه يحدث لقراءة الاميتر عندئذ ؟
ضع علامة (ـ) امام الافتراضه الذي تتخاها
- أ - قراءة الاميتر تزيد قليلاً ☐
 - ب - قراءة الاميتر تنقل قليلاً ☐
 - ج - قراءة الاميتر له تتغير ☐
 - د - قراءة الاميتر تنحدر الى صفر . ☐

③ علل اختيارك للجواب :

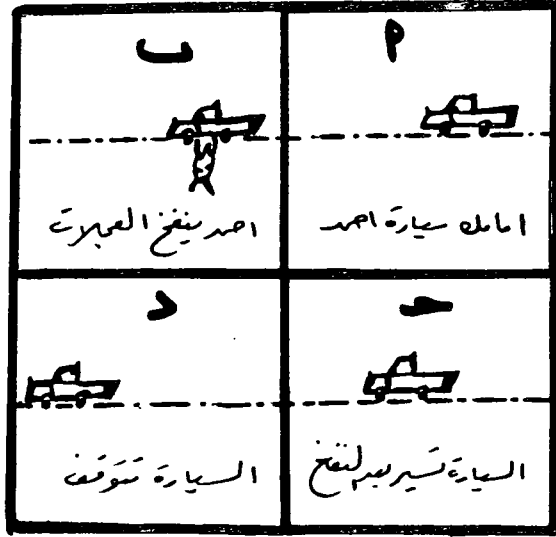
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(١١)



- ٥) متى تكون عربة احمد في كامل طاقتها ؟
 ضع علامة (س) امام الاجابة التي تختارها .
- ١- ☐ قبل انه ينفخ احمد العبورة .
 - ٢- ☐ بعد انه نفخ احمد العبورة .
 - ٣- ☐ عندما كانت تسير بعد نفخ العبورة .
 - ٤- ☐ عندما توقفت .
 - ٥- ☐ طاقة العربة واحدة في كل الارض .

٦) علل سبب اختيارك الاجابتي .

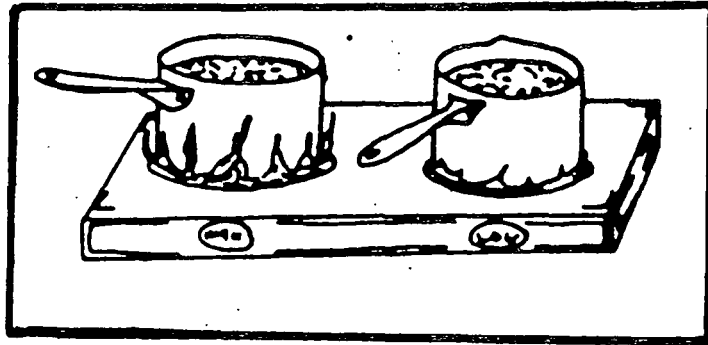
.....

.....

.....

.....

(١٢)



وضعت طبخاً قدره يغلياً على موقد الغاز. وعندما صعدت القدرية
 يغلياً خفضت درجة اللهب تحت أحد صاهته يظل يغلي وتركت الآخر على
 درجة اللهب العالية وقد ضمنت أنه القدر الذي على اللهب العالي سيظهر
 البطاطس أسرع من الآخر.

قالت لا تسيئاً أنه ذلك له يحدث أي فارص من زمره ظهر البطاطس.

أي من الاثنين تعتقد أنها على صواب ؟

على اجابتي (اختياراً لأصداها)

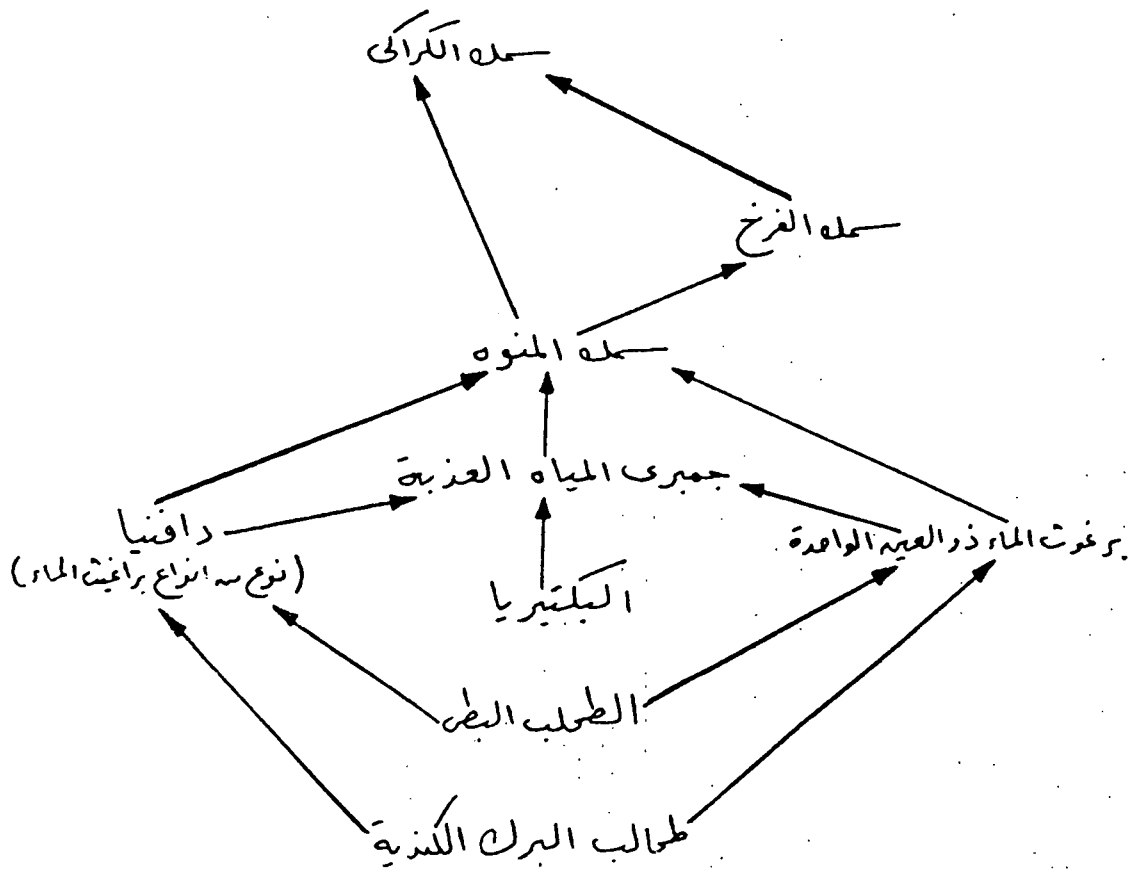
اختيارات العلوم العامة للعام ١٥ سنة

اولا : التاريخ الطبي

(١)

الشكل التالي يبين كيفية بعض الحيوانات والنباتات التي تعيش في قبة مائية تعتمد غذائها على بعض البعوض .

لاحظ انه العلامة [ب → م] تعني انه ب يتغذى على م



اذا حدث نقص مفاجئ في عدد برغوث الماء ذو العين الواحدة فماذا يمكن ان يحدث لاعداد الدافنيا (النوع الآخر من براغيث الماء) ؟

علل اجابته :

(٣)

حاصل زرايع على بعض البذور من نبتة البصل واحدة .

غرس نصف البذور من قطعة خضراء من الحديثة بينما غرس النصف الآخر من الدفيئة (استنتجت زجاج من لزراعة النباتات) . بذل المزارع أقصى مجهود لكن نجأ كما انه البذور المخرسة من الدفيئة تقابل معاملة واحدة تماماً منه حيث انها تلتقى نفس كمية الضوء والماء والحرارة من نفس نوع التربة .

بعد ١٢ شهراً جمع المزارع كل البصل الناتج وراعى يزنه كل بصلة على حدة .

والمجدول الآتى يبينه النتائج التى حصل عليها :

حجم البصلة	صغيرة جداً	صغيرة	متوسطة	كبيرة	كبيرة جداً
بصل الحديثة	٧	١٠	٨٣	٩	٨
بصل الدفيئة	—	٣	١١٠	٤	—

٥) تلتقت البذور المخرسة من الدفيئة نفس المعاملة تماماً من الضاية بل مع هذا انبتت بصلاً مختلف الاحجام .

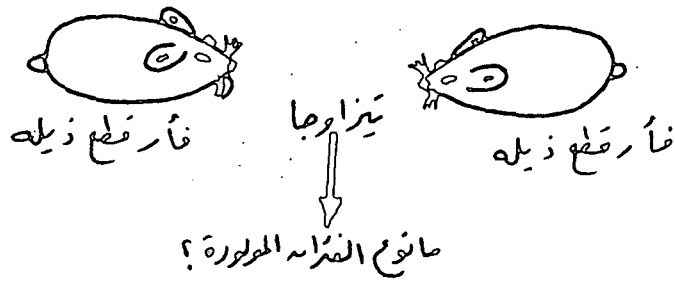
هل يمكنه ذلك انه تشرح السبب من هذا ؟

٦) اختلف البصل الناتج من الحديثة مع البصل الناتج من الدفيئة كما ترى اما من الجدول .

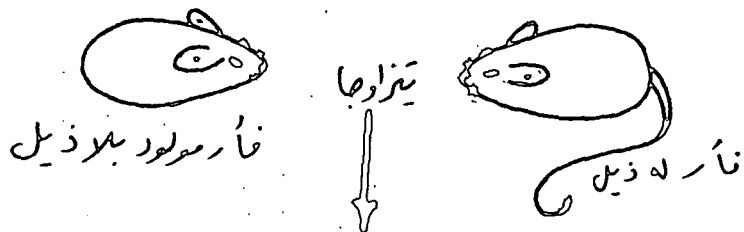
هل يمكنه ذلك انه تشرح السبب من هذا ؟

(٥)

في إحدى تجارب الفارسي العظيم الراهب قام أحد العلماء بتربية الفئران . وفي أحد
صفاء فيه التجارب وجد العالم فأراً مولوداً بلا ذيل . وصيه بلغ هذا الفأر مرحلة التزاوج
زوجه العلم بأنثى طبيعية (لا ذيل) فأنجبا بيضة الفئران الصغيرة لا ذيل لها .
ولكن تبين أن العالم من الحصول على عدد أكبر من الفئران التي بلا ذيل قام بقطع ذيول بيضة الفئران البالغة
والتي لا ذيل وتماماً بتزويجها . ومع ذلك عند التكاثر وجد أنه كل الفئران المولودة لا ذيل .



هل تعتقد لو أن العالم قام بتزويج فئران من مقطوعة الذيل مرة أخرى فستحصل على فئران بلا ذيل ؟
اشرح إجابتك . . .



لماذا ينتج (يجب) الفأر الذي لا ذيل له بيضة الفئران التي لا ذيل ؟

(٦)

نباتات الفلبيوت وهو نبات ذو اوراقه طويلة ورقيقة ومخططة قادر على التكاثُر بطريقتيه :

المجموعة (١) : عنه طريقه الازهار والبذور

المجموعة (٢) : عنه طريقه انتاج سوره جاربه (سوره رقيقة تنجذر على الارضه

مولده بذله نباتات جديدة منفصلة عنه النبات الام)

أخذت نباتات تكاثرة بكلتا الطريقتيه وزرعت تحت ظروف مماثلة . وبعد ١٠٠ يوم تم وزنه كل نبات على حده .

والجدول الآتي يوضح نتائج هذه التجربة :

المجموعة (١) : من الازهار والبذور	متوسط الوزنه ٣٦ جم	مدى الاززانه يتراوح بين ١٦ - ٥٥ جم
المجموعة (٢) : من السوره الجاربه	متوسط الوزنه ٤١ جم	مدى الاززانه يتراوح بين ٢٨ - ٤٢ جم

اى من العبارات الآتية يعلل تماماً سبب ارتفاع مدى الاززانه من المجموعة (١) عنه من المجموعة (٢) ؟

ضع علامة (س) امام العبارة التي تتفهم على .

١ - نباتات المجموعة (١) زرعت تحت ساطع محيطية اوسع من نباتات المجموعة (٢) . ☐

ب - كل نباتات المجموعة (٢) كانت اقل من نباتات المجموعة (١) بعد ١٠٠ يوم . ☐

ج - نباتات المجموعة (٢) اصبحت على بعضه التغيرات الاصلية الثقيلة بينما لم تحصل نباتات المجموعة (١) هذه التغيرات الاصلية (سلالات جديدة) . ☐

د - نباتات المجموعة (١) تكونت نتيجة التزاوج الجنسي بينا نباتات المجموعة (٢) انتجت دونه صدرت التزاوج الجنسي . ☐

هـ - السوره الجاربه تنبع نباتات هضيفة ولقيلة باعداد متساوية . ☐

(٨)

فئة بالفة تأنيلا دورة الطمى (العادة الشرىة) بانتظام .

من اللىم الاول سه شهر مارس بدأت دورسلا ثم توقفت من يوم ٦ مارس .

ثم عادت اللىم دورسلا القالية من يوم ٢٩ مارس .

ضع علامة (ـ) امام الفترة الزمنية التى تصفد انه افراز (الفضال)
البوليفة سه احد مبيضى الفتاة الكثر احتمال اشادها .

- | | | | | |
|--------------------------|-----|----|---------|------|
| <input type="checkbox"/> | ٢- | سه | ١ - ٦ | مارس |
| <input type="checkbox"/> | ٥- | سه | ٧ - ١١ | مارس |
| <input type="checkbox"/> | ٨- | سه | ١٢ - ١٦ | مارس |
| <input type="checkbox"/> | ١٠- | سه | ١٧ - ٢٢ | مارس |
| <input type="checkbox"/> | ١١- | سه | ٢٣ - ٢٨ | مارس |

(٩)

الحيوان	عدد الذرية (السل) في كل موسم للتكاثر	كيف يتم التكاثر	كمية الرعاية الابوية
السمكة	أكثر من ١٠٠٠٠	يضع البهيمة بدورها غلفة	لا توجد
البرمائيات	أكثر من ١٠٠٠	يضع البهيمة بدورها غلفة	لا توجد
الزواحف	أكثر من ١٠٠	يضع البهيمة باغلفة	قليلة جدا
الطيور	٥ - ١٠	تضع بيضا بقشرة	كبيرة
الثدييات	١ - ٥	تلد	كبيرة

بهيمة هذا الجدول عدد الذرية (السل أو النسل) التي يمكن أن ينتجها
زوج من تلك الحيوانات التي تنتمي إلى هذه المجموعات من موسم
التكاثر (هذا بالطبع ليس الاستثناءات).

سنعين بالمعلومات من الجدول السابق أذكر سببها لماذا تضع السمكة

أعدادا من البهيمة أكثر بمراحل مما تضع إحدى الزواحف؟

١-

٢-

(١٠)

ضع معلقة (س) امام الفقرات التي تعتقد انه التزاوج الجنسي قد حدث فيها
ومعده (خ) امام الفقرات التي لم يحدث فيها تزاوج جنسي .

٢- زرع رجل مائة نبتة من ازهار الزنبق الاصفر من حديقة . ومن كل ربيع
كانه يطفئ كل الازهار وهي مازالت في براعمها ويبقى . بعد عدة سنوات
هذه الرجل حديقة واستخرج منها اكثر من ٣٠٠ نبتة من الزنبق الاصفر .

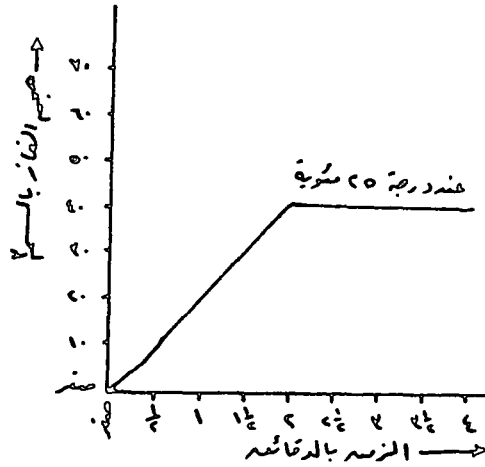
ج- اخذ طبيب خلية بويضة من امرأة وقام بتخصيب البويضة من انبوب
اختبار مستخدما صيونا صويا من زوج المرأة ثم وضع البويضة بعد تخصيبها
من رحم المرأة لكن تنمو وبعد تسعة اشهر ولدت المرأة طفلا .

هـ- وضع مزارع لبصه الكناكيت التي عمرها يوم واحد من قفص مع لبصا وبعد
عدة اسابيع فصل كل كنفكون من قفص خاص ثم قام بتغذيتهم من الكفص
نحوهم وبدأوا جميعا يضعون البيض .

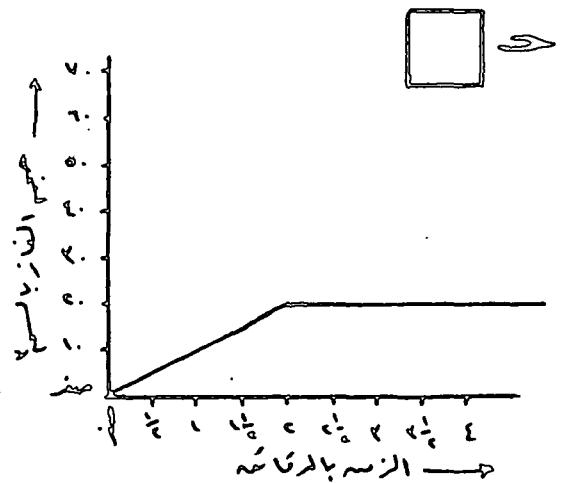
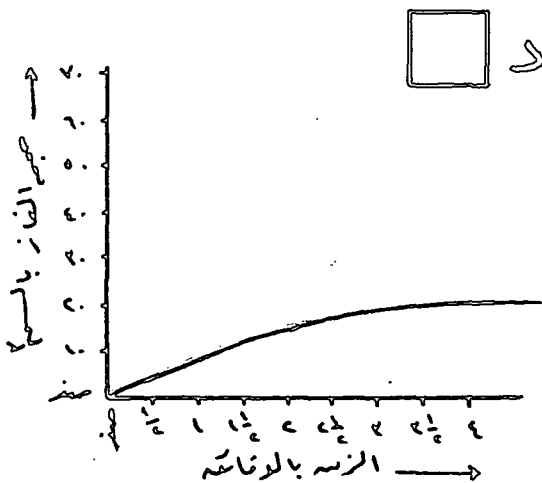
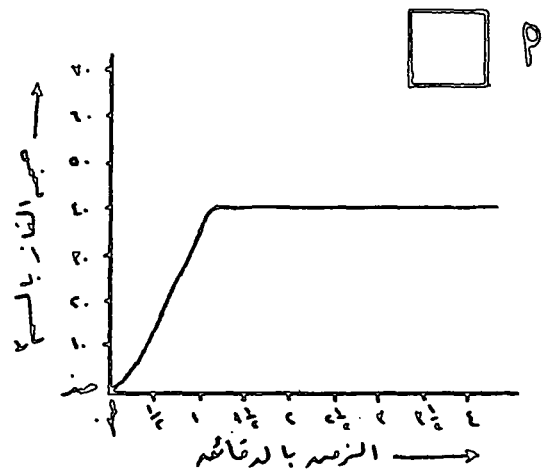
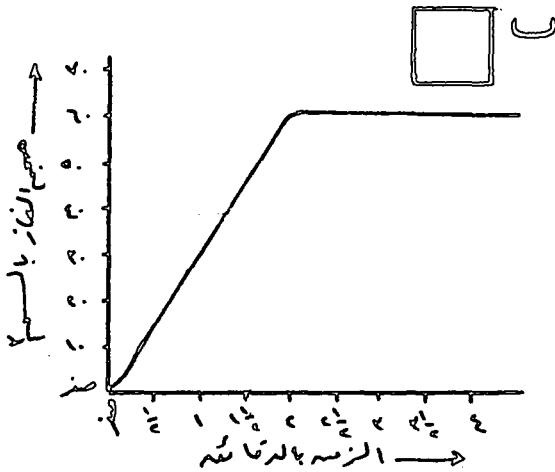
د- شجرة حمير مزروعة من بستانه ومن كل ربيع يجيد البستان عددًا
كبيراً من نباتات الحمير تنمو فيه الحائث حول الشجرة .

ثانياً : اللحياء (١)

اصنف المزيد من مادة صلبة الى محلول عند درجة حرارة ٥٠ مئوية فتصاعد غاز .
وقد تم قياس حجم هذا الغاز بالنسبة للزمن كما هو موضح بالرسم البيان الآتي :



تكررت نفس التجربة مع المحلول عند درجة حرارة ٣٥ مئوية .
ضع علامة (س) امام الرسم البيان الذي تعتقد انه يبين نتيجة هذه التجربة .



(٢)

بعد اجراء محيدته التجارب يفقد العلماء الآله ١٠ :

- كل المواد تتكون من ذرات
- تتكون الذرات من هيزونات (محتوية على بروتونات) محاطة بالالكترونات
- عدد الالكترونات والبروتونات في ذرة متعادلة متساوي دائما

اليه الآله بعضه المعلومات عن عدد البروتونات والالكترونات في ثلوث ذرات مختلفة :

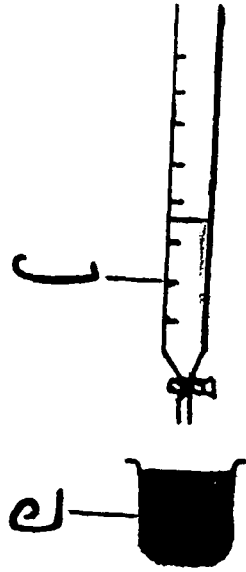
عدد البروتونات	عدد الالكترونات	
١٠	١٠	نيون
١١	١١	صوديوم
١٢	١٢	مغنسيوم

إذا أخذ إلكترون واحد من ذرة الصوديوم فماذا يتبقى ؟
ضع علامة (٤) امام الاجابة الصحيحة .

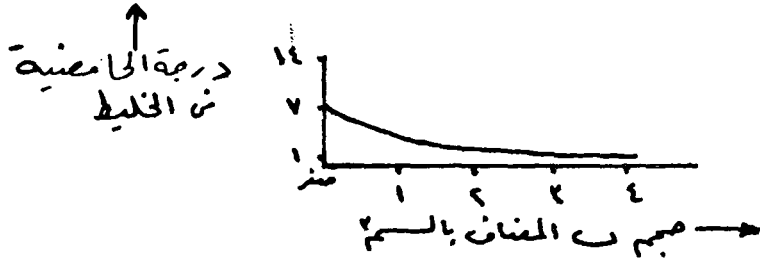
- ☐ أ ذرة نيون
☐ ب ايون نيون سالب
☐ ج ايون مغنسيوم موجب
☐ د ايون صوديوم موجب
☐ هـ ايون صوديوم سالب

(٥)

احده التلميذات لديه هذا الجهاز :



قاسه التلميذ درجة الحامضية في ك
 كانت تصنيف ب الى ك بمقدار ٣ من المرة الواحدة
 بعد كل اضافة كانت تقيس درجة الحامضية في ك
 الرسم البيان الازتيبيته النتائج التي حصلت عليه :



من الرسم البيان ماذا نستنتج ما كانت تفعله التلميذ ؟
 ضع علامة (س) امام الاربعة التي تختارها (اجابة واحدة فقط) .

- ☐ ا - كانت تصنيف حمضه الى قلوب
- ☐ ب - كانت تصنيف ماء الى قلوب
- ☐ ج - كانت تصنيف حمضه الى ماء
- ☐ د - كانت تصنيف قلوب الى ماء
- ☐ هـ - كانت تصنيف قلوب الى حمضه

(٦)

عندما تم بناء المنزل الجديد كانت مواسير الماء البارد والساحنة من المطبخ
للاصحة برافعة .

بعد فترة وجيزة اصبحت المواسير من الخارج ممتعة وقائمة (مغطاة بطبقة داكنة رقيقة)
وكانت مواسير الماء الساخنة أكثر قساوة من مواسير الماء البارد .

⑤ ما الذي جعل المواسير ممتعة من الخارج ؟

⑥ لماذا تعتقد انه مواسير الماء الساخنة كانت أكثر قساوة من مواسير الماء البارد ؟

⑦ من اى مادة تصنع انابيب القناة (العمدة) تتكون ؟

ثالثاً: الفيزياء

(٢)

البلد قائمة ببعض الأعمال .

بعض هذه الأعمال يتطلب نقل طاقة ، والبعض الآخر لا يتطلب ذلك .

ضع علامة (ـ) امام تلك الأعمال التي تحتاج الى طاقة منقولة .

رضع علامة (X) امام تلك التي لا تستغل فيها طاقة .

(ضع (ـ) او (X) امام كل عمل)

☐ ٢- شحف ما يضغط ديوس رسم في لوحة .

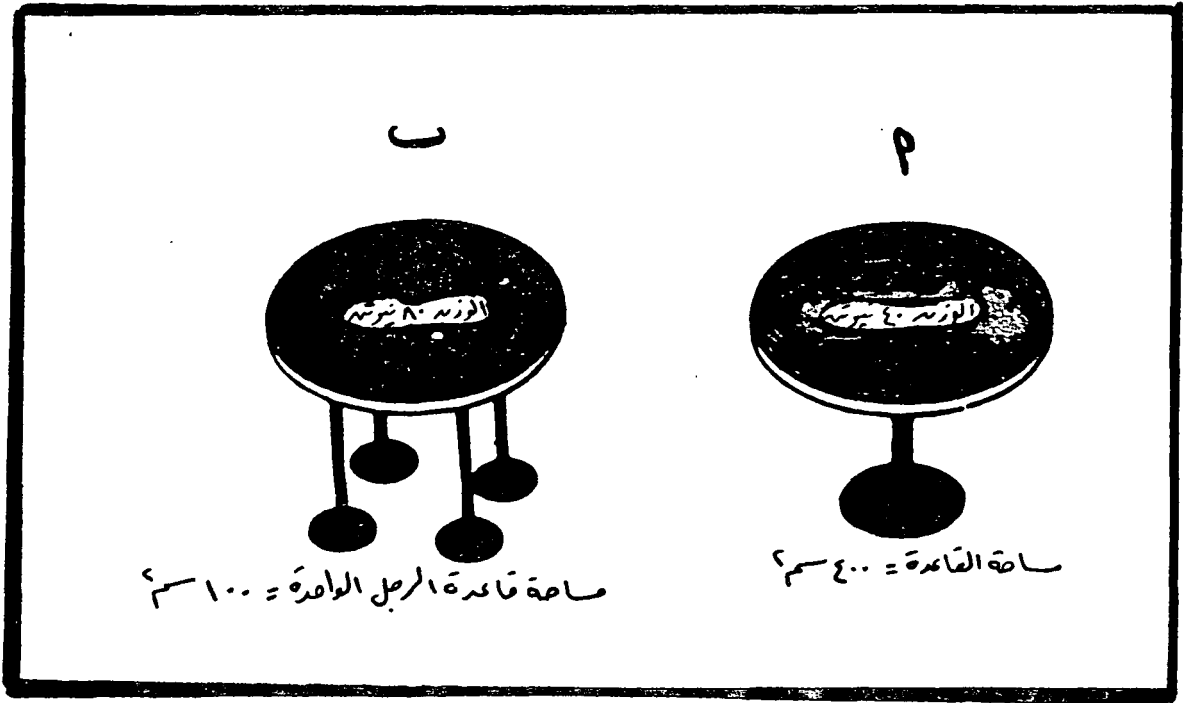
☐ ب- رف يند صفامه الكتب .

☐ هـ- شحف يرفع سيارة مستخدماً رافعة (كريليه) .

☐ د- دنش يرفع حمولة .

☐ هـ- دنش يحافظ على حمولة في مكانه .

(٤)

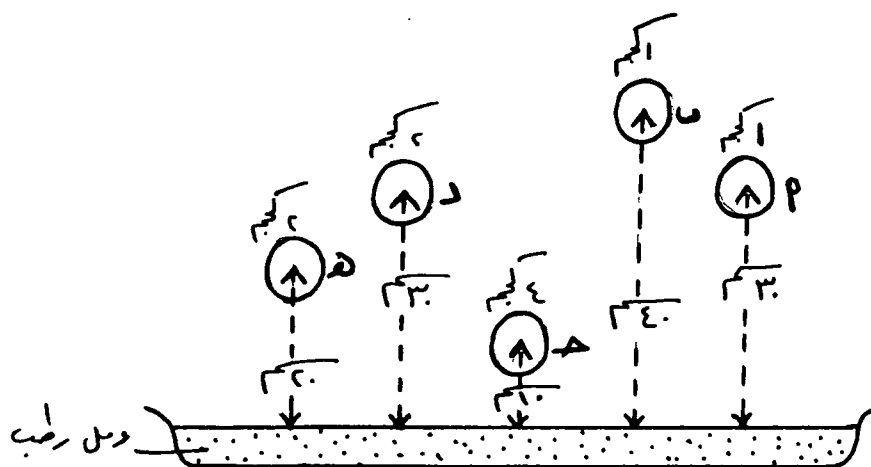


لعلك لاحظت أنه بعد قطع الأثاث سوى السجادة تختل.

(٢) أي هاتين المادتين في الشكل يكون أثره خصوصاً على نفس السجادة
أكثر من الآخر؟

(ج) علل اختيارك لهذه المادتين.

(٦)



امامه خمس كرات متساوية الحجم ومختلفة الكتلة .
اسقطت هذه الكرات من ارتفاعات مختلفة على سطح رطب متنوع من طبيعته
كبير كما يظهر من الشكل .

① أي كرة من هذه الكرات ستغوص لأكثر من الرمل ؟

ا ☐

ب ☐

ج ☐

د ☐

هـ ☐

② أي كرة من هذه الكرات ستغوص لأقل من الرمل ؟

ا ☐

ب ☐

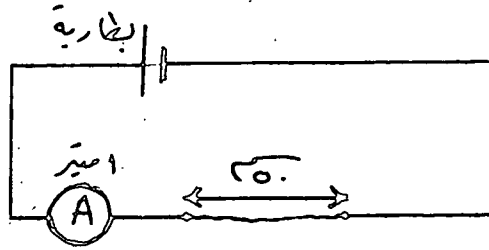
ج ☐

د ☐

هـ ☐

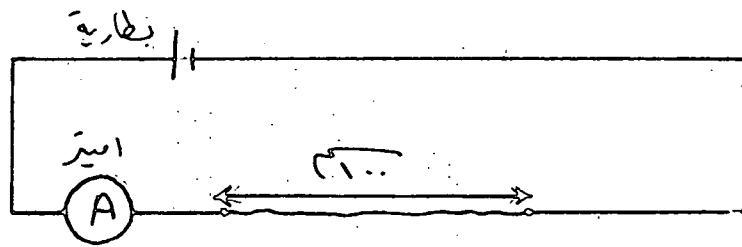
(٨)

قام احد التلاميذ بتوصيل سلك مقاومة طوله ٥٠ سم دائرة كهربائية
تم لاحظ قراءة التيار على الأميتر .



وكانت قراءة الأميتر ؟ أمبير

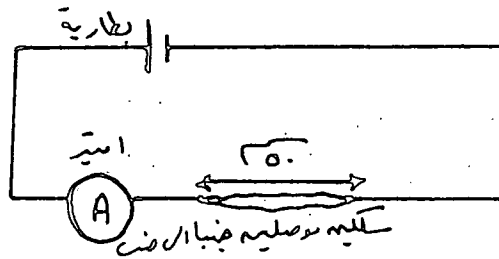
(P) كم تكون قراءة التيار على الأميتر اذا استخدم التلميذ سلك مقاومة
من نفس النوع البعد ولكنه طوله ١٠٠ سم ؟



قراءة الأميتر تزداد

علل اجابته

(ب) كم تكون قراءة التيار على الأميتر اذا استخدم التلميذ سلكي مقاومة طول كل
منهما ٥٠ سم موصلين على التوازي [جنباً الى جنب] ؟

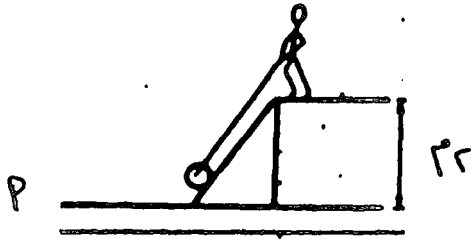


قراءة الأميتر تزداد

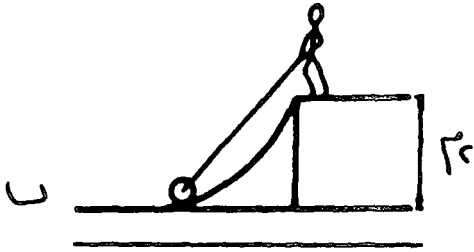
علل اجابته

(٩)

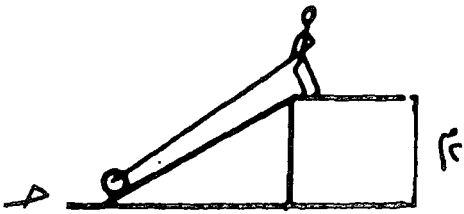
تأمل الصور أمامك تجد رجلًا يرفع السلوانة ثقيلة من أسفل إلى أعلى
مستخدماً حبلها على الواع خشبية مختلفة الأشكال .
المجل الآتية تحدد مقدار الطاقة التي يبذلها في كل حالة .
① ضع علامة (ـ) أمام العبارة التي تتفق مع .



□ ① الطاقة التي يبذلها لرفع السلوانة على
الوع الخشبي (P) أقل من الآخرين .



□ ② الطاقة التي يبذلها لرفع السلوانة على
الوع الخشبي (B) أقل من الآخرين .



□ ③ الطاقة التي يبذلها لرفع السلوانة على
الوع الخشبي (A) أقل من الآخرين .

□ ④ الطاقة التي يبذلها لرفع السلوانة متساوية على أي نوع
خشبي يستخدمه .

⑤ علل اختيارك للإجابة الصحيحة .

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Appendix III
Results of the Study of Animism

Table (1)
Responses of Egyptian Children Age 5 in Percentage
(No. 30, M = 12, F = 18)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	-	-	-	0.000	2
	Insect	83.3	83.3	83.3	16.7	11.1	13.3	-	5.6	3.3	-	-	-	-	-
	Toad	100	94.4	96.7	-	5.6	3.3	-	-	-	-	-	-	-	-
	Plant	50.0	66.7	60.0	41.7	11.1	23.3	8.3	22.2	16.7	-	-	-	4.048	2
	Fish	75.0	83.3	80.0	16.7	11.1	13.3	8.3	5.6	6.7	-	-	-	-	-
Dead	Snake	-	-	-	66.7	83.3	76.7	33.3	5.6	16.7	-	11.1	6.7	-	-
	Frog	-	5.6	3.3	66.7	55.6	60.0	25.0	27.8	26.7	8.3	11.1	10.0	-	-
	Fish	-	-	-	66.7	72.2	70.0	8.3	22.2	16.7	25.0	5.6	13.3	2.907	2
	Dogfish	8.3	5.6	6.7	58.3	61.1	60.0	25.0	27.8	26.7	8.3	5.6	6.7	-	-
	Lizard	8.3	5.6	6.7	58.3	50.0	53.3	33.3	38.9	36.7	-	5.6	3.3	0.006	1
	Shrew	8.3	16.7	13.3	50.0	55.6	53.3	25.0	22.2	23.3	16.7	5.6	10.0	1.329	3
Never	China Bird	-	11.1	6.7	25.0	11.1	16.7	66.7	61.1	63.3	8.3	16.7	13.3	-	-
	Stone	16.7	22.2	20.0	41.7	27.8	33.3	41.7	38.9	40.0	-	11.1	6.7	-	-
	Water	25.0	22.2	23.3	8.3	11.1	10.0	58.3	55.6	56.7	8.3	11.1	10.0	0.145	3
	China Lady	8.3	-	3.3	25.0	33.3	30.0	58.3	61.1	60.0	8.3	5.6	6.7	-	-
	Candle	25.0	5.6	13.3	25.0	72.2	53.3	33.3	16.7	23.3	16.7	5.6	10.0	6.798	3
	Crocodile	8.3	5.6	6.7	33.3	27.8	30.0	58.3	55.6	56.7	-	11.1	6.7	0.0	1
	Clock	50.0	38.9	43.3	16.7	33.3	26.7	25.0	16.7	20.0	8.3	11.1	10.0	1.261	3
	Teddy Bear	16.7	11.1	13.3	25.0	11.1	16.7	41.7	61.1	53.3	16.7	16.7	16.7	1.510	3

M = Male F = Female T = Total

Table (2)
Responses of Egyptian Children Age 6 in Percentage
(No. 27, M = 9, F = 18)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	33.3	38.9	37.0	44.4	33.3	37.0	11.1	22.2	18.5	11.1	5.6	7.4	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	88.9	72.2	77.8	11.1	22.2	18.5	-	-	-	-	5.6	3.7	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	77.8	72.2	74.1	22.2	27.8	25.9	-	-	-	-	-
	Frog	11.1	11.1	11.1	66.7	55.6	59.3	22.2	33.3	29.6	-	-	-	0.375	2
	Fish	-	11.1	7.4	66.7	72.2	70.4	33.3	11.1	18.5	-	5.6	3.7	-	-
	Dogfish	-	5.6	3.7	77.8	72.2	74.1	11.1	22.2	18.5	11.1	-	3.7	-	-
	Lizard	-	-	-	55.6	83.3	74.1	33.3	16.7	22.2	11.1	-	3.7	-	-
	Shrew	-	-	-	66.7	72.2	70.4	33.3	22.2	25.9	-	5.6	3.7	-	-
Never	China Bird	-	-	-	11.1	22.2	18.5	66.7	61.1	63.0	22.2	16.7	18.5	0.529	2
	Stone	-	-	-	22.2	44.4	37.0	77.8	44.4	55.6	-	11.1	7.4	-	-
	Water	66.7	27.8	40.7	-	22.2	14.8	33.3	38.9	37.0	-	11.1	7.4	-	-
	China Lady	-	5.6	3.7	33.3	33.3	33.3	66.7	55.6	59.3	-	5.6	3.7	-	-
	Candle	22.2	33.3	29.6	33.3	22.2	25.9	44.4	38.9	40.7	-	5.6	3.7	-	-
	Crocodile	-	-	-	22.2	44.4	37.0	77.8	50.0	59.3	-	5.6	3.7	-	-
	Clock	33.3	22.2	25.9	-	11.1	7.4	44.4	55.6	51.9	22.2	11.1	14.8	-	-
	Teddy Bear	-	-	-	11.1	38.9	29.6	77.8	55.6	63.0	11.1	5.6	7.4	-	-

M = Male F = Female T = Total

Table (3)
Responses of Egyptian Children Age 7 in Percentage
(No. 29, M = 14, F = 15)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	71.4	66.7	69.0	21.4	6.7	13.8	-	20.0	10.3	7.1	6.7	6.9	3.970	3
	Insect	78.6	86.7	82.8	-	-	-	7.1	6.7	6.9	14.3	6.7	10.3	0.466	2
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	71.4	66.7	69.0	7.1	6.7	6.9	14.3	13.3	13.8	7.1	13.3	10.3	0.299	3
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	78.6	80.0	79.3	21.4	20.0	20.7	-	-	-	-	-
	Frog	7.1	-	3.4	78.6	80.0	79.3	14.3	13.3	13.8	-	6.7	3.4	-	-
	Fish	-	-	-	78.6	80.0	79.3	21.4	20.0	20.7	-	-	-	-	-
	Dogfish	-	-	-	85.7	80.0	82.8	14.3	20.0	17.2	-	-	-	-	-
	Lizard	14.3	13.3	13.8	78.6	80.0	79.3	7.1	6.7	6.9	-	-	-	0.010	2
	Shrew	7.1	6.7	6.9	78.6	80.0	79.3	14.3	13.3	13.8	-	-	-	0.009	2
Never	China Bird	-	-	-	35.7	40.0	37.9	64.3	46.7	55.2	-	13.3	6.9	2.309	2
	Stone	-	-	-	28.6	26.7	27.6	71.4	66.7	69.0	-	6.7	3.4	-	-
	Water	57.1	46.7	51.7	-	-	-	42.9	40.0	41.4	-	13.3	6.9	2.035	2
	China Lady	-	-	-	28.6	20.0	24.1	71.4	66.7	69.0	-	13.3	6.9	2.111	2
	Candle	14.3	40.0	27.6	-	-	-	85.7	60.0	72.4	-	-	-	-	-
	Crocodile	-	-	-	35.7	26.7	31.0	64.3	60.0	62.1	-	13.3	6.9	2.079	2
	Clock	21.4	26.7	24.1	14.3	6.7	10.3	57.1	60.0	58.6	7.1	6.7	6.9	0.501	3
	Teddy Bear	-	-	-	35.7	20.0	27.6	57.1	66.7	62.1	7.1	13.3	10.3	1.022	2

M = Male F = Female T = Total

Table (4)
Responses of Egyptian Children Age 8 in Percentage
(No. 27, M = 13, F = 14)

Class- ifica- tion	Objects	Categories of Response												χ^2	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	76.9	71.4	74.1	23.1	14.3	18.5	-	7.1	3.7	-	7.1	3.7	-	-
	Insect	100	85.7	92.6	-	14.3	7.4	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	76.9	78.6	77.8	15.4	7.1	11.1	7.7	7.1	7.4	-	7.1	3.7	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	92.3	85.7	88.9	7.7	7.1	7.4	-	7.1	3.7	-	-
	Frog	-	-	-	84.6	92.9	88.9	15.4	7.1	11.1	-	-	-	-	-
	Fish	15.4	14.3	14.8	84.6	85.7	85.2	-	-	-	-	-	-	-	-
	Dogfish	-	-	-	84.6	78.6	81.5	15.4	21.4	18.5	-	-	-	-	-
	Lizard	15.4	-	7.4	84.6	92.9	88.9	-	7.1	3.7	-	-	-	-	-
	Shrew	7.7	14.3	11.1	92.3	85.7	88.9	-	-	-	-	-	-	-	-
Never	China Bird	-	-	-	23.1	21.4	22.2	61.5	71.4	66.7	15.4	7.1	11.1	0.519	2
	Stone	-	-	-	7.7	7.1	7.4	84.6	85.7	85.2	7.7	7.1	7.4	0.006	2
	Water	23.1	28.6	25.9	7.7	7.1	7.4	61.5	57.1	59.3	7.7	7.1	7.4	0.106	3
	China Lady	-	-	-	23.1	28.6	25.9	61.5	64.3	63.0	15.4	7.1	11.1	0.499	2
	Candle	-	-	-	7.7	21.4	14.8	76.9	71.4	74.1	15.4	7.1	11.1	1.298	2
	Crocodile	-	-	-	23.1	21.4	22.2	69.2	78.6	74.1	7.7	-	3.7	-	-
	Clock	30.8	35.7	33.3	-	-	-	61.5	64.3	63.0	7.7	-	3.7	-	-
	Teddy Bear	-	-	-	30.8	28.6	29.6	61.5	71.4	66.7	7.7	-	3.7	-	-

M = Male F = Female T = Total

Table (5)
Responses of Egyptian Children Age 9 in Percentage
(No. 32, M = 18, F = 14)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	94.4	100	96.9	—	—	—	5.6	—	3.1	—	—	—	—	—
	Insect	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	94.4	100	96.9	5.6	—	3.1	—	—	—	—	—	—	—	—
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	100	92.9	96.9	—	7.1	3.1	—	—	—	—	—
	Frog	—	—	—	88.9	85.7	87.5	11.1	7.1	9.4	—	7.1	3.1	—	—
	Fish	—	—	—	100	92.9	96.9	—	7.1	3.1	—	—	—	—	—
	Dogfish	—	—	—	94.4	85.7	90.6	5.6	14.3	9.4	—	—	—	—	—
	Lizard	—	—	—	94.4	78.6	87.5	5.6	21.4	12.5	—	—	—	—	—
	Shrew	—	—	—	100	85.7	93.8	—	14.3	6.3	—	—	—	—	—
Never	China Bird	—	—	—	—	21.4	9.4	100	78.6	90.6	—	—	—	—	—
	Stone	—	—	—	—	—	—	100	100	100	—	—	—	—	—
	Water	22.2	28.6	25.0	—	14.3	6.3	72.2	57.1	65.6	5.6	—	3.1	—	—
	China Lady	—	—	—	11.1	7.1	9.4	88.9	92.9	90.6	—	—	—	—	—
	Candle	—	—	—	5.6	14.3	9.4	94.4	78.6	87.5	—	7.1	3.1	—	—
	Crocodile	—	—	—	5.6	21.4	12.5	94.4	78.6	87.5	—	—	—	—	—
	Clock	5.6	7.1	6.3	5.6	—	3.1	83.3	85.7	84.4	5.6	7.1	6.3	—	—
	Teddy Bear	—	—	—	22.2	28.6	25.0	77.8	71.4	75.0	—	—	—	—	—

M = Male F = Female T = Total

Table (6)
Responses of Egyptian Children Age 10 in Percentage
(No. 26, M = 14, F = 12)

Class- ifica- tion	Objects	Categories of Response												X^2	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Frog	-	-	-	92.9	100	96.2	7.1	-	3.8	-	-	-	-	-
	Fish	-	8.3	3.8	100	91.7	96.2	-	-	-	-	-	-	-	-
	Dogfish	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Lizard	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Shrew	-	-	-	85.7	100	92.3	14.3	-	7.7	-	-	-	-	-
Never	China Bird	-	-	-	7.1	8.3	7.7	92.9	91.7	92.3	-	-	-	-	-
	Stone	-	-	-	7.1	-	3.8	92.9	100	96.2	-	-	-	-	-
	Water	57.1	25.0	42.3	-	-	-	7.1	8.3	7.7	35.7	66.7	50.0	-	-
	China Lady	-	-	-	-	16.7	7.7	100	83.3	92.3	-	-	-	-	-
	Candle	-	-	-	7.1	8.3	7.7	92.9	91.7	92.3	-	-	-	-	-
	Crocodile	-	-	-	-	-	-	100	100	100	-	-	-	-	-
	Clock	7.1	25.0	15.4	14.3	-	7.7	78.6	75.0	76.9	-	-	-	-	-
	Teddy Bear	-	-	-	7.1	16.7	11.5	92.9	83.3	88.5	-	-	-	-	-

M = Male F = Female T = Total

Table (7)
Responses of Egyptian Children Age 11 in Percentage
(No. 33, M = 18, F = 15)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	100	93.3	97.0	-	6.7	3.0	-	-	-	-	-
	Frog	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Fish	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Dogfish	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Lizard	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Shrew	-	-	-	94.4	100	97.0	5.6	-	3.0	-	-	-	-	-
Never	China Bird	-	-	-	11.1	6.7	9.1	88.9	93.3	90.9	-	-	-	-	-
	Stone	-	-	-	5.6	26.7	15.2	94.4	73.3	84.8	-	-	-	-	-
	Water	50.0	40.0	45.5	27.8	13.3	21.2	11.1	20.0	15.2	11.1	26.7	18.2	2.500	3
	China Lady	-	-	-	5.6	13.3	9.1	94.4	86.7	90.9	-	-	-	-	-
	Candle	-	-	-	11.1	-	6.1	88.9	100	93.9	-	-	-	-	-
	Crocodile	-	-	-	11.1	6.7	9.1	88.9	93.3	90.9	-	-	-	-	-
	Clock	5.6	-	3.0	-	13.3	6.1	94.4	86.7	90.9	-	-	-	-	-
	Teddy Bear	-	-	-	5.6	13.3	9.1	94.4	86.7	90.9	-	-	-	-	-

M = Male F = Female T = Total

Table (8)
Responses of English Children Age 5 in Percentage
(No. 27, M = 10, F = 17)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	30.0	52.9	44.4	40.0	17.6	25.9	30.0	23.5	25.9	—	5.9	3.7	—	—
	Insect	90.0	94.1	92.6	—	—	—	10.0	5.9	7.4	—	—	—	—	—
	Toad	90.0	94.1	92.6	—	—	—	10.0	5.9	7.4	—	—	—	—	—
	Plant	60.0	70.6	66.7	20.0	11.8	14.8	20.0	17.6	18.5	—	—	—	0.413	2
	Fish	90.0	88.2	88.9	—	5.9	3.7	10.0	5.9	7.4	—	—	—	—	—
Dead	Snake	10.0	5.9	7.4	70.0	70.6	70.4	20.0	23.5	22.2	—	—	—	—	—
	Frog	10.0	17.6	14.8	60.0	52.9	55.6	30.0	29.4	29.6	—	—	—	0.306	2
	Fish	10.0	5.9	7.4	30.0	58.8	48.1	60.0	35.3	44.4	—	—	—	—	—
	Dogfish	—	11.8	7.4	50.0	64.7	59.3	50.0	23.5	33.3	—	—	—	—	—
	Lizard	10.0	23.5	18.5	50.0	64.7	59.3	40.0	11.8	22.2	—	—	—	3.111	2
	Shrew	30.0	29.4	29.6	30.0	47.1	40.7	40.0	23.5	29.6	—	—	—	1.027	2
Never	China Bird	10.0	5.9	7.4	20.0	52.9	40.7	60.0	41.2	48.1	10.0	—	3.7	—	—
	Stone	—	5.9	3.7	30.0	52.9	44.4	60.0	35.3	44.4	10.0	5.9	7.4	—	—
	Water	30.0	35.3	33.3	20.0	17.6	18.5	50.0	41.2	44.4	—	5.9	3.7	—	—
	China Lady	20.0	11.8	14.8	20.0	47.1	37.0	50.0	35.3	40.7	10.0	5.9	7.4	—	—
	Candle	30.0	17.6	22.2	30.0	47.1	40.7	30.0	23.5	25.9	10.0	11.8	11.1	1.001	3
	Crocodile	—	5.9	3.7	40.0	64.7	55.6	50.0	29.4	37.0	10.0	—	3.7	—	—
	Clock	60.0	41.2	48.1	10.0	29.4	22.2	30.0	29.4	29.6	—	—	—	1.531	2
	Teddy Bear	10.0	17.6	14.8	50.0	47.1	48.1	30.0	29.4	29.6	10.0	5.9	7.4	—	—

M = Male F = Female T = Total

Table (9)
Responses of English Children Age 6 in Percentage
(No. 26, M = 14, F = 12)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	14.3	41.7	26.9	57.1	41.7	50.0	28.6	16.7	23.1	—	—	—	2.506	2
	Insect	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	64.3	83.3	73.1	14.3	8.3	11.5	21.4	8.3	15.4	—	—	—	1.239	2
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	78.6	100	88.5	21.4	—	11.5	—	—	—	—	—
	Frog	7.1	—	3.8	57.1	91.7	73.1	35.7	8.3	23.1	—	—	—	—	—
	Fish	7.1	—	3.8	64.3	91.7	76.9	28.6	8.3	19.2	—	—	—	—	—
	Dogfish	7.1	—	3.8	78.6	100	88.5	14.3	—	7.7	—	—	—	—	—
	Lizard	7.1	—	3.8	64.3	91.7	76.9	28.6	8.3	19.2	—	—	—	—	—
	Shrew	21.4	8.3	15.4	50.0	91.7	69.2	28.6	—	15.4	—	—	—	5.769	2
Never	China Bird	14.3	25.0	19.2	35.7	41.7	38.5	50.0	33.3	42.3	—	—	—	0.869	2
	Stone	14.3	8.3	11.5	42.9	58.3	50.0	42.9	33.3	38.5	—	—	—	0.660	2
	Water	28.6	25.0	26.9	28.6	41.7	34.6	42.9	25.0	34.6	—	8.3	3.8	—	—
	China Lady	14.3	25.0	19.2	50.0	33.3	42.3	35.7	41.7	38.5	—	—	—	0.869	2
	Candle	14.3	8.3	11.5	50.0	75.0	61.5	35.7	16.7	26.9	—	—	—	1.725	2
	Crocodile	—	8.3	3.8	50.0	58.3	53.8	50.0	33.3	42.3	—	—	—	0.211	1
	Clock	57.1	41.7	50.0	7.1	25.0	15.4	28.6	33.3	30.8	7.1	—	3.8	—	—
	Teddy Bear	7.1	25.0	15.4	64.3	33.3	50.0	28.6	41.7	34.6	—	—	—	2.897	2

M = Male F = Female T = Total

Table (10)
Responses of English Children Age 7 in Percentage
(No. 24, M = 17, F = 7)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	76.5	71.4	75.0	5.9	—	4.2	17.6	14.3	16.7	—	14.3	4.2	—	—
	Insect	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	76.5	100	83.3	17.6	—	12.5	5.9	—	4.2	—	—	—	—	—
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	88.2	100	91.7	11.8	—	8.3	—	—	—	—	—
	Frog	5.9	—	4.2	70.6	100	79.2	23.5	—	16.7	—	—	—	—	—
	Fish	5.9	—	4.2	64.7	100	75.0	29.4	—	20.8	—	—	—	—	—
	Dogfish	—	—	—	76.5	100	83.3	23.5	—	16.7	—	—	—	—	—
	Lizard	5.9	—	4.2	70.6	100	79.2	23.5	—	16.7	—	—	—	—	—
	Shrew	23.5	14.3	20.8	58.8	71.4	62.5	17.6	14.3	16.7	—	—	—	0.363	2
Never	China Bird	11.8	—	8.3	29.4	42.9	33.3	58.8	57.1	58.3	—	—	—	—	—
	Stone	11.8	—	8.3	23.5	28.6	25.0	64.7	71.4	66.7	—	—	—	—	—
	Water	35.3	14.3	29.2	17.6	28.6	20.8	41.2	57.1	45.8	5.9	—	4.2	—	—
	China Lady	5.9	—	4.2	29.4	42.9	33.3	64.7	57.1	62.5	—	—	—	—	—
	Candle	5.9	—	4.2	35.3	57.1	41.7	58.8	42.9	54.2	—	—	—	—	—
	Crocodile	5.9	—	4.2	35.3	57.1	41.7	58.8	42.9	54.2	—	—	—	—	—
	Clock	23.5	14.3	20.8	17.6	28.6	20.8	58.8	57.1	58.3	—	—	—	0.489	2
	Teddy Bear	5.9	—	4.2	35.3	28.6	33.3	58.8	71.4	62.5	—	—	—	—	—

M = Male F = Female T = Total

Table (11)
Responses of English Children Age 8 in Percentage
(No. 24, M = 12, F = 12)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	91.7	75.0	83.3	-	16.7	8.3	8.3	8.3	8.3	-	-	-	2.200	2
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	75.0	91.7	83.3	25.0	-	12.5	-	8.3	4.2	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	91.7	75.0	83.3	8.3	16.7	12.5	-	8.3	4.2	-	-
	Frog	-	-	-	91.7	91.7	91.7	8.3	8.3	8.3	-	-	-	-	-
	Fish	-	-	-	100	83.3	91.7	-	16.7	8.3	-	-	-	-	-
	Dogfish	-	-	-	83.3	83.3	83.3	16.7	16.7	16.7	-	-	-	-	-
	Lizard	-	8.3	4.2	100	91.7	95.8	-	-	-	-	-	-	-	-
	Shrew	8.3	-	4.2	91.7	91.7	91.7	-	8.3	4.2	-	-	-	-	-
Never	China Bird	8.3	8.3	8.3	33.3	25.0	29.2	50.0	66.7	58.3	8.3	-	4.2	0.171	1
	Stone	8.3	-	4.2	25.0	16.7	20.8	58.3	83.3	70.8	8.3	-	4.2	-	-
	Water	41.7	50.0	45.8	16.7	25.0	20.8	41.7	16.7	29.2	-	8.3	4.2	-	-
	China Lady	-	8.3	4.2	41.7	16.7	29.2	50.0	75.0	62.5	8.3	-	4.2	-	-
	Candle	16.7	8.3	12.5	33.3	16.7	25.0	50.0	75.0	62.5	-	-	-	1.600	2
	Crocodile	8.3	8.3	8.3	41.7	25.0	33.3	50.0	66.7	58.3	-	-	-	0.786	2
	Clock	25.0	41.7	33.3	8.3	-	4.2	66.7	58.3	62.5	-	-	-	-	-
	Teddy Bear	16.7	16.7	16.7	25.0	16.7	20.8	58.3	66.7	62.5	-	-	-	0.267	2

M = Male F = Female T = Total

Table (12)
Responses of English Children Age 9 in Percentage
(No. 30, M = 10, F = 20)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Insect	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	80.0	95.0	90.0	20.0	5.0	10.0	—	—	—	—	—	—	—	—
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	100	95.0	96.7	—	5.0	3.3	—	—	—	—	—
	Frog	—	—	—	100	75.0	83.3	—	20.0	13.3	—	5.0	3.3	—	—
	Fish	—	—	—	100	85.0	90.0	—	15.0	10.0	—	—	—	—	—
	Dogfish	—	5.0	3.3	90.0	85.0	86.7	10.0	10.0	10.0	—	—	—	—	—
	Lizard	—	—	—	100	85.0	90.0	—	15.0	10.0	—	—	—	—	—
	Shrew	—	5.0	3.3	100	90.0	93.3	—	5.0	3.3	—	—	—	—	—
Never	China Bird	—	—	—	10.0	35.0	26.7	90.0	65.0	73.3	—	—	—	—	—
	Stone	—	—	—	20.0	30.0	26.7	80.0	70.0	73.3	—	—	—	—	—
	Water	30.0	35.0	33.3	20.0	15.0	16.7	40.0	45.0	43.3	10.0	5.0	6.7	—	—
	China Lady	—	—	—	20.0	30.0	26.7	80.0	70.0	73.3	—	—	—	—	—
	Candle	—	—	—	10.0	30.0	23.3	90.0	65.0	73.3	—	5.0	3.3	—	—
	Crocodile	—	—	—	20.0	40.0	33.3	80.0	60.0	66.7	—	—	—	—	—
	Clock	10.0	35.0	26.7	20.0	20.0	20.0	70.0	45.0	53.3	—	—	—	2.344	2
	Teddy Bear	—	5.0	3.3	20.0	45.0	36.7	80.0	50.0	60.0	—	—	—	—	—

M = Male F = Female T = Total

Table (13)
Responses of English Children Age 10 in Percentage
(No. 24, M = 11, F = 13)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	81.8	100	91.7	9.1	-	4.2	9.1	-	4.2	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	100	92.3	95.8	-	7.7	4.2	-	-	-	-	-
	Frog	-	-	-	90.9	92.3	91.7	9.1	7.7	8.3	-	-	-	-	-
	Fish	-	7.7	4.2	100	84.6	91.7	-	7.7	4.2	-	-	-	-	-
	Dogfish	-	-	-	100	76.9	87.5	-	23.1	12.5	-	-	-	-	-
	Lizard	-	-	-	100	92.3	95.8	-	7.7	4.2	-	-	-	-	-
	Shrew	-	-	-	100	100	100	-	-	-	-	-	-	-	-
Never	China Bird	9.1	-	4.2	36.4	23.1	29.2	54.5	76.9	66.7	-	-	-	-	-
	Stone	-	-	-	54.5	15.4	33.3	45.5	84.6	66.7	-	-	-	-	-
	Water	72.7	30.8	50.0	9.1	15.4	12.5	18.2	53.8	3.57	-	-	-	4.308	2
	China Lady	18.2	-	8.3	18.2	15.4	16.7	63.6	84.6	75.0	-	-	-	-	-
	Candle	27.3	7.7	16.7	36.4	30.8	33.3	36.4	61.5	50.0	-	-	-	2.182	2
	Crocodile	-	-	-	54.5	23.1	37.5	45.5	76.9	62.5	-	-	-	-	-
	Clock	27.3	38.5	33.3	27.3	-	12.5	45.5	61.5	54.2	-	-	-	4.054	2
	Teddy Bear	-	-	-	63.6	15.4	37.5	36.4	84.6	62.5	-	-	-	-	-

M = Male F = Female T = Total

Table (14)
Responses of English Children Age 11 in Percentage
(No. 30, M = 16, F = 14)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		M	F	T	M	F	T	M	F	T	M	F	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	100	92.9	96.7	-	7.1	3.3	-	-	-	-	-
	Frog	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Fish	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Dogfish	-	-	-	87.5	100	93.3	12.5	-	6.7	-	-	-	-	-
	Lizard	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Shrew	-	-	-	93.8	100	96.7	6.3	-	3.3	-	-	-	-	-
Never	China Bird	-	-	-	37.5	42.9	40.0	62.5	57.1	60.0	-	-	-	0.000	1
	Stone	-	-	-	43.8	57.1	50.0	56.3	42.9	50.0	-	-	-	0.134	1
	Water	43.8	7.1	26.7	37.5	50.0	43.3	18.8	42.9	30.0	-	-	-	5.468	2
	China Lady	-	-	-	50.0	42.9	46.7	50.0	57.1	53.3	-	-	-	0.001	1
	Candle	6.3	-	3.3	43.8	57.1	50.0	50.0	42.9	46.7	-	-	-	0.001	1
	Crocodile	-	-	-	56.3	57.1	56.7	43.8	42.9	43.3	-	-	-	0.0	1
	Clock	25.0	14.3	20.0	18.8	42.9	30.0	56.3	42.9	50.0	-	-	-	2.143	2
	Teddy Bear	-	-	-	37.5	50.0	43.3	62.5	50.0	56.7	-	-	-	0.102	1

M = Male F = Female T = Total

Table (15)
Comparative Responses of Egyptian and English Children Age 5
in Percentage (No. 57, Eg = 30, En = 27)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	33.3	44.4	38.6	33.3	25.9	29.8	33.3	25.9	29.8	—	3.7	1.8	0.346	1
	Insect	83.3	92.6	87.7	13.3	—	7.0	3.3	7.4	5.3	—	—	—	4.187	2
	Toad	96.7	92.6	94.7	3.3	—	1.8	—	7.4	3.5	—	—	—	—	—
	Plant	60.0	66.7	63.2	23.3	14.8	19.3	16.7	18.5	17.5	—	—	—	0.662	2
	Fish	80.0	88.9	84.2	13.3	3.7	8.8	6.7	7.4	7.0	—	—	—	1.647	2
Dead	Snake	—	7.4	3.5	76.7	70.4	73.7	16.7	22.2	19.3	6.7	—	3.5	0.057	1
	Frog	3.3	14.8	8.8	60.0	55.6	57.9	26.7	29.6	28.1	10.0	—	5.3	4.928	3
	Fish	—	7.4	3.5	70.0	48.1	59.6	16.7	44.4	29.8	13.3	—	7.0	1.984	1
	Dogfish	6.7	7.4	7.0	60.0	59.3	59.6	26.7	33.3	29.8	6.7	—	3.5	0.0	1
	Lizard	6.7	18.5	12.3	53.3	59.3	56.1	36.7	22.2	29.8	3.3	—	1.8	0.033	1
	Shrew	13.3	29.6	21.1	53.3	40.7	47.4	23.3	29.6	26.3	10.0	—	5.3	5.182	3
Never	China Bird	6.7	7.4	7.0	16.7	40.7	28.1	63.3	48.1	56.1	13.3	3.7	8.8	5.031	3
	Stone	20.0	3.7	12.3	33.3	44.4	38.6	40.0	44.4	42.1	6.7	7.4	7.0	3.605	3
	Water	23.3	33.3	28.1	10.0	18.5	14.0	56.7	44.4	50.9	10.0	3.7	7.0	2.461	3
	China Lady	3.3	14.8	8.8	30.0	37.0	33.3	60.0	40.7	50.9	6.7	7.4	7.0	3.394	3
	Candle	13.3	22.2	17.5	53.3	40.7	47.4	23.3	25.9	24.6	10.0	11.1	10.5	1.171	3
	Crocodile	6.7	3.7	5.3	30.0	55.6	42.1	56.7	37.0	47.4	6.7	3.7	5.3	3.834	3
	Clock	43.3	48.1	45.6	26.7	22.2	24.6	20.0	29.6	24.6	10.0	—	5.3	3.423	3
	Teddy Bear	13.3	14.8	14.0	16.7	48.1	31.6	53.3	29.6	42.1	16.7	7.4	12.3	7.370	3

Eg = Egyptian En = English T = Total

Table (16)
Comparative Responses of Egyptian and English Children Age 6
in Percentage (No. 53, Eg = 27, En = 26)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	37.0	26.9	32.1	37.0	50.0	43.4	18.5	23.1	20.8	7.4	—	3.8	2.994	3
	Insect	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	77.8	73.1	75.5	18.5	11.5	15.1	—	15.4	7.5	3.7	—	1.9	0.006	1
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	74.1	88.5	81.1	25.9	11.5	18.9	—	—	—	—	—
	Frog	11.1	3.8	7.5	59.3	73.1	66.0	29.6	23.1	26.4	—	—	—	1.525	2
	Fish	7.4	3.8	5.7	70.4	76.9	73.6	18.5	19.2	18.9	3.7	—	1.9	0.053	1
	Dogfish	3.7	3.8	3.8	74.1	88.5	81.1	18.5	7.7	13.2	3.7	—	1.9	—	—
	Lizard	—	3.8	1.9	74.1	76.9	75.5	22.2	19.2	20.8	3.7	—	1.9	0.0	1
	Shrew	—	15.4	7.5	70.4	69.2	69.8	25.9	15.4	20.8	3.7	—	1.9	0.0	1
Never	China Bird	—	19.2	9.4	18.5	38.5	28.3	63.0	42.3	52.8	18.5	—	9.4	12.938**	3
	Stone	—	11.5	5.7	37.0	50.0	43.4	55.6	38.5	47.2	7.4	—	3.8	6.375	3
	Water	40.7	26.9	34.0	14.8	34.6	24.5	37.0	34.6	35.8	7.4	3.8	5.7	3.180	3
	China Lady	3.7	19.2	11.3	33.3	42.3	37.7	59.3	38.5	49.1	3.7	—	1.9	1.536	1
	Candle	29.6	11.5	20.8	25.9	61.5	43.4	40.7	26.9	34.0	3.7	—	1.9	0.596	1
	Crocodile	—	3.8	1.9	37.0	53.8	45.3	59.3	42.3	50.9	3.7	—	1.9	0.920	1
	Clock	25.9	50.0	37.7	7.4	15.4	11.3	51.9	30.8	41.5	14.8	3.8	9.4	5.886	3
	Teddy Bear	—	15.4	7.5	29.6	50.0	39.6	63.0	34.6	49.1	7.4	—	3.8	9.637*	3

Eg = Egyptian En = English T = Total

* p <0.05> 0.01

** p <0.01> 0.001

Table (17)
Comparative Responses of Egyptian and English Children Age 7
in Percentage (No. 53, Eg = 29, En = 24)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	69.0	75.0	71.7	13.8	4.2	9.4	10.3	16.7	13.2	6.9	4.2	5.7	1.927	3
	Insect	82.8	100	90.6	—	—	—	6.9	—	3.8	10.3	—	5.7	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	69.0	83.3	75.5	6.9	12.5	9.4	13.8	4.2	9.4	10.3	—	5.7	4.569	3
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	79.3	91.7	84.9	20.7	8.3	15.1	—	—	—	—	—
	Frog	3.4	4.2	3.8	79.3	79.2	79.2	13.8	16.7	15.1	3.4	—	1.9	—	—
	Fish	—	4.2	1.9	79.3	75.0	77.4	20.7	20.8	20.8	—	—	—	0.002	1
	Dogfish	—	—	—	82.8	83.3	83.0	17.2	16.7	17.0	—	—	—	—	—
	Lizard	13.8	4.2	9.4	79.3	79.2	79.2	6.9	16.7	11.3	—	—	—	2.397	2
	Shrew	6.9	20.8	13.2	79.3	62.5	71.7	13.8	16.7	15.1	—	—	—	2.521	2
Never	China Bird	—	8.3	3.8	37.9	33.3	35.8	55.2	58.3	56.6	6.9	—	3.8	0.0	1
	Stone	—	8.3	3.8	27.6	25.0	26.4	69.0	66.7	67.9	3.4	—	1.9	0.0	1
	Water	51.7	29.2	41.5	—	20.8	9.4	41.4	45.8	43.4	6.9	4.2	5.7	7.884*	3
	China Lady	—	4.2	1.9	24.1	33.3	28.3	69.0	62.5	66.0	6.9	—	3.8	0.041	1
	Candle	27.6	4.2	17.0	—	41.7	18.9	72.4	54.2	64.2	—	—	—	17.006**	2
	Crocodile	—	4.2	1.9	31.0	41.7	35.8	62.1	54.2	58.5	6.9	—	3.8	0.091	1
	Clock	24.1	20.8	22.6	10.3	20.8	15.1	58.6	58.3	58.5	6.9	—	3.8	0.0	1
	Teddy Bear	—	4.2	1.9	27.6	33.3	30.2	62.1	62.5	62.3	10.3	—	5.7	0.0	1

Eg = Egyptian En = English T = Total

* $p < 0.05 > 0.01$

** $p < 0.001$

Table (18)
Comparative Responses of Egyptian and English Children Age 8
in Percentage (No. 51, Eg = 27, En = 24)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	74.1	83.3	78.4	18.5	8.3	13.7	3.7	8.3	5.9	3.7	-	2.0	0.213	1
	Insect	92.6	100	96.1	7.4	-	3.9	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	77.8	83.3	80.4	11.1	12.5	11.8	7.4	4.2	5.9	3.7	-	2.0	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	88.9	83.3	86.3	7.4	12.5	9.8	3.7	4.2	3.9	-	-
	Frog	-	-	-	88.9	91.7	90.2	11.1	8.3	9.8	-	-	-	-	-
	Fish	14.8	-	7.8	85.2	91.7	88.2	-	8.3	3.9	-	-	-	-	-
	Dogfish	-	-	-	81.5	83.3	82.4	18.5	16.7	17.6	-	-	-	-	-
	Lizard	7.4	4.2	5.9	88.9	95.8	92.2	3.7	-	2.0	-	-	-	-	-
	Shrew	11.1	4.2	7.8	88.9	91.7	90.2	-	4.2	2.0	-	-	-	-	-
Never	China Bird	-	8.3	3.9	22.2	29.2	25.5	66.7	58.3	62.7	11.1	4.2	7.8	0.105	1
	Stone	-	4.2	2.0	7.4	20.8	13.7	85.2	70.8	78.4	7.4	4.2	5.9	0.815	1
	Water	25.9	45.8	35.3	7.4	20.8	13.7	59.3	29.2	45.1	7.4	4.2	5.9	5.873	3
	China Lady	-	4.2	2.0	25.9	29.2	27.5	63.0	62.5	62.7	11.1	4.2	7.8	0.0	1
	Candle	-	12.5	5.9	14.8	25.0	19.6	74.1	62.5	68.6	11.1	-	5.9	6.962	3
	Crocodile	-	8.3	3.9	22.2	33.3	27.5	74.1	58.3	66.7	3.7	-	2.0	0.797	1
	Clock	33.3	33.3	33.3	-	4.2	2.0	63.0	62.5	62.7	3.7	-	2.0	0.0	1
	Teddy Bear	-	16.7	7.8	29.6	20.8	25.5	66.7	62.5	64.7	3.7	-	2.0	0.0	1

Eg = Egyptian En = English T = Total

Table (19)
Comparative Responses of Egyptian and English Children Age 9
in Percentage (No. 62, Eg = 32, En = 30)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	96.9	100	98.4	-	-	-	3.1	-	1.6	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	96.9	90.0	93.5	3.1	10.0	6.5	-	-	-	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	96.9	96.7	96.8	3.1	3.3	3.2	-	-	-	-	-
	Frog	-	-	-	87.5	83.3	85.5	9.4	13.3	11.3	3.1	3.3	3.2	0.248	2
	Fish	-	-	-	96.9	90.0	93.5	3.1	10.0	6.5	-	-	-	-	-
	Dogfish	-	3.3	1.6	90.6	86.7	88.7	9.4	10.0	9.7	-	-	-	-	-
	Lizard	-	-	-	87.5	90.0	88.7	12.5	10.0	11.3	-	-	-	-	-
	Shrew	-	3.3	1.6	93.8	93.3	93.5	6.3	3.3	4.8	-	-	-	-	-
Never	China Bird	-	-	-	9.4	26.7	17.7	90.6	73.3	82.3	-	-	-	2.098	1
	Stone	-	-	-	-	26.7	12.9	100	73.3	87.1	-	-	-	-	-
	Water	25.0	33.3	29.0	6.3	16.7	11.3	65.6	43.3	54.8	3.1	6.7	4.8	3.663	3
	China Lady	-	-	-	9.4	26.7	17.7	90.6	73.3	82.3	-	-	-	2.098	1
	Candle	-	-	-	9.4	23.3	16.1	87.5	73.3	80.6	3.1	3.3	3.2	2.258	2
	Crocodile	-	-	-	12.5	33.3	22.6	87.5	66.7	77.4	-	-	-	2.745	1
	Clock	6.3	26.7	16.1	3.1	20.0	11.3	84.4	53.3	69.4	6.3	-	3.2	11.933*	3
	Teddy Bear	-	3.3	1.6	25.0	36.7	30.6	75.0	60.0	67.7	-	-	-	0.982	1

Eg = Egyptian En = English T = Total

* p <0.01> 0.001

Table (20)
Comparative Responses of Egyptian and English Children Age 10
in Percentage (No. 50, Eg = 26, En = 24)

Class- ifica- tion	Objects	Categories of Response												X^2	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	100	91.7	96.0	-	4.2	2.0	-	4.2	2.0	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	100	95.8	98.0	-	4.2	2.0	-	-	-	-	-
	Frog	-	-	-	96.2	91.7	94.0	3.8	8.3	6.0	-	-	-	-	-
	Fish	3.8	4.2	4.0	96.2	91.7	94.0	-	4.2	2.0	-	-	-	-	-
	Dogfish	-	-	-	100	87.5	94.0	-	12.5	6.0	-	-	-	-	-
	Lizard	-	-	-	100	95.8	98.0	-	4.2	2.0	-	-	-	-	-
	Shrew	-	-	-	92.3	100	96.0	7.7	-	4.0	-	-	-	-	-
Never	China Bird	-	4.2	2.0	7.7	29.2	18.0	92.3	66.7	80.0	-	-	-	-	-
	Stone	-	-	-	3.8	33.3	18.0	96.2	66.7	82.0	-	-	-	-	-
	Water	42.3	50.0	46.0	-	12.5	6.0	7.7	37.5	22.0	50.0	-	26.0	20.451**	3
	China Lady	-	8.3	4.0	7.7	16.7	12.0	92.3	75.0	84.0	-	-	-	3.449	1
	Candle	-	16.7	8.0	7.7	33.3	20.0	92.3	50.0	72.0	-	-	-	11.538*	2
	Crocodile	-	-	-	-	37.5	18.0	100	62.5	82.0	-	-	-	-	-
	Clock	15.4	33.3	24.0	7.7	12.5	10.0	76.9	54.2	66.0	-	-	-	2.943	2
	Teddy Bear	-	-	-	11.5	37.5	24.0	88.5	62.5	76.0	-	-	-	3.298	1

Eg = Egyptian En = English T = Total

* $p < 0.01 > 0.001$

** $p < 0.001$

Table (21)
Comparative Responses of Egyptian and English Children Age 11
in Percentage (No. 63, Eg = 33, En = 30)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	97.0	96.7	96.8	3.0	3.3	3.2	-	-	-	-	-
	Frog	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Fish	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Dogfish	-	-	-	100	93.3	96.8	-	6.7	3.2	-	-	-	-	-
	Lizard	-	-	-	100	100	100	-	-	-	-	-	-	-	-
	Shrew	-	-	-	97.0	96.7	96.8	3.0	3.3	3.2	-	-	-	-	-
Never	China Bird	-	-	-	9.1	40.0	23.8	90.9	60.0	76.2	-	-	-	6.660*	1
	Stone	-	-	-	15.2	50.0	31.7	84.8	50.0	68.3	-	-	-	7.272*	1
	Water	45.5	26.7	36.5	21.2	43.3	31.7	15.2	30.0	22.2	18.2	-	9.5	10.955*	3
	China Lady	-	-	-	9.1	46.7	27.0	90.9	53.3	73.0	-	-	-	9.435**	1
	Candle	-	3.3	1.6	6.1	50.0	27.0	93.9	46.7	71.4	-	-	-	14.969**	1
	Crocodile	-	-	-	9.1	56.7	31.7	90.9	43.3	68.3	-	-	-	14.293**	1
	Clock	3.0	20.0	11.1	6.1	30.0	17.5	90.9	50.0	71.4	-	-	-	12.912**	2
	Teddy Bear	-	-	-	9.1	43.3	25.4	90.9	56.7	74.6	-	-	-	8.002*	1

Eg = Egyptian En = English T = Total

* p <0.01> 0.001

** p <0.001

Table (22)
Comparative Responses of Egyptian and English Children as a Whole
Sample in Percentage (No. 389, Eg = 204, En = 185)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	73.5	76.2	74.8	14.2	12.4	13.4	9.3	10.3	10.0	2.5	1.1	1.8	1.357 [*]	3
	Insect	94.1	98.9	96.4	2.9	—	1.5	1.5	1.1	1.3	1.5	—	.8	8.508	3
	Toad	99.5	98.9	99.2	.5	—	.3	—	1.1	.5	—	—	—	—	—
	Plant	83.3	84.3	83.8	8.8	9.2	9.0	5.4	6.5	5.9	2.5	—	1.3	4.757	3
	Fish	97.1	98.4	97.7	2.0	.5	1.3	1.0	1.1	1.0	—	—	—	1.549	2
Dead	Snake	—	1.1	.5	87.7	89.2	88.4	10.8	9.2	10.0	1.5	.5	1.0	3.291	3
	Frog	2.5	3.2	2.8	81.9	82.2	82.0	13.2	14.1	13.6	2.5	.5	1.5	2.260	3
	Fish	3.4	2.7	3.1	85.8	82.2	84.1	8.3	15.1	11.6	2.5	—	1.3	8.733 [*]	3
	Dogfish	1.5	2.2	1.8	84.3	83.2	83.8	12.7	14.6	13.6	1.5	—	.8	3.235	3
	Lizard	3.9	4.3	4.1	83.3	85.4	84.3	11.8	10.3	11.1	1.0	—	.5	2.097	3
	Shrew	4.4	10.3	7.2	82.4	79.5	81.0	11.3	10.3	10.8	2.0	—	1.0	8.445 [*]	3
Never	China Bird	1.0	6.5	3.6	17.2	34.1	25.2	75.0	58.4	67.1	6.9	1.1	4.1	31.048 ^{**}	3
	Stone	2.9	3.8	3.3	17.6	36.2	26.5	76.0	58.4	67.6	3.4	1.6	2.6	18.522 ^{**}	3
	Water	36.3	34.6	35.5	8.8	24.3	16.2	40.7	37.8	39.3	14.2	3.2	9.0	27.653 ^{**}	3
	China Lady	—	7.0	3.9	19.6	33.5	26.2	75.5	57.8	67.1	3.9	1.6	2.8	22.674 ^{**}	3
	Candle	9.8	9.7	9.8	16.7	39.5	27.5	69.6	48.6	59.6	3.9	2.2	3.1	26.444 ^{**}	3
	Crocodile	1.0	2.7	1.8	20.1	44.9	31.9	76.0	51.9	64.5	2.9	.5	1.8	32.100 ^{**}	3
	Clock	21.1	33.0	26.7	8.8	18.4	13.4	64.2	48.1	56.6	5.9	.5	3.3	24.495 ^{**}	3
	Teddy Bear	2.0	7.6	4.6	21.1	38.9	29.6	71.6	52.4	62.5	5.4	1.1	3.3	28.119 ^{**}	3

Eg = Egyptian En = English T = Total

* p <0.05> 0.01

** p <0.001

Table (23)
Comparative Responses of Egyptian and English Children Age groups
(5-6) in Percentage (No. 110, Eg = 57, En = 53)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	35.1	35.8	35.5	35.1	37.7	36.4	26.3	24.5	25.5	3.5	1.9	2.7	0.357	3
	Insect	91.2	96.2	93.6	7.0	—	3.6	1.8	3.8	2.7	—	—	—	4.203	2
	Toad	98.2	96.2	97.3	1.8	—	.9	—	3.8	1.8	—	—	—	—	—
	Plant	68.4	69.8	69.1	21.1	13.2	17.3	8.8	17.0	12.7	1.8	—	.9	0.0	1
	Fish	89.5	94.3	91.8	7.0	1.9	4.5	3.5	3.8	3.6	—	—	—	1.667	2
Dead	Snake	—	3.8	1.8	75.4	79.2	77.3	21.1	17.0	19.1	3.5	—	1.8	4.301	3
	Frog	7.0	9.4	8.2	59.6	64.2	61.8	28.1	26.4	27.3	5.3	—	2.7	3.103	3
	Fish	3.5	5.7	4.5	70.2	62.3	66.4	17.5	32.1	24.5	8.8	—	4.5	7.551	3
	Dogfish	5.3	5.7	5.5	66.7	73.6	70.0	22.8	20.8	21.8	5.3	—	2.7	3.038	3
	Lizard	3.5	11.3	7.3	63.2	67.9	65.5	29.8	20.8	25.5	3.5	—	1.8	5.147	3
	Shrew	7.0	22.6	14.5	61.4	54.7	58.2	24.6	22.6	23.6	7.0	—	3.6	8.582*	3
Never	China Bird	3.5	13.2	8.2	17.5	39.6	28.2	63.2	45.3	54.5	15.8	1.9	9.1	15.356**	3
	Stone	10.5	7.5	9.1	35.1	47.2	40.9	47.4	41.5	44.5	7.0	3.8	5.5	1.990	3
	Water	31.6	30.2	30.9	12.3	26.4	19.1	47.4	39.6	43.6	8.8	3.8	6.4	4.347	3
	China Lady	3.5	17.0	10.0	31.6	39.6	35.5	59.6	39.6	50.0	5.3	3.8	4.5	7.823*	3
	Candle	21.1	17.0	19.1	40.4	50.9	45.5	31.6	26.4	29.1	7.0	5.7	6.4	1.248	3
	Crocodile	3.5	3.8	3.6	33.3	54.7	43.6	57.9	39.6	49.1	5.3	1.9	3.6	5.612	3
	Clock	35.1	49.1	41.8	17.5	18.9	18.2	35.1	30.2	32.7	12.3	1.9	7.3	5.589	3
	Teddy Bear	7.0	15.1	10.9	22.8	49.1	35.5	57.9	32.1	45.5	12.3	3.8	8.2	13.437**	3

Eg = Egyptian En = English T = Total

* p <0.05> 0.01

** p <0.01> 0.001

Table (24)
Comparative Responses of Egyptian and English Children Age Groups
(7-8) in Percentage (No. 104, Eg = 56, En = 48)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	71.4	79.2	75.0	16.1	6.3	11.5	7.1	12.5	9.6	5.4	2.1	3.8	3.859	3
	Insect	87.5	100	93.3	3.6	—	1.9	3.6	—	1.9	5.4	—	2.9	—	—
	Toad	100	100	100	—	—	—	—	—	—	—	—	—	—	—
	Plant	73.2	83.3	77.9	8.9	12.5	10.6	10.7	4.2	7.7	7.1	—	3.8	5.521	3
	Fish	100	100	100	—	—	—	—	—	—	—	—	—	—	—
Dead	Snake	—	—	—	83.9	87.5	85.6	14.3	10.4	12.5	1.8	2.1	1.9	0.056	1
	Frog	1.8	2.1	1.9	83.9	85.4	84.6	12.5	12.5	12.5	1.8	—	1.0	0.0	1
	Fish	7.1	2.1	4.8	82.1	83.3	82.7	10.7	14.6	12.5	—	—	—	1.690	2
	Dogfish	—	—	—	82.1	83.3	82.7	17.9	16.7	17.3	—	—	—	0.0	1
	Lizard	10.7	4.2	7.7	83.9	87.5	85.6	5.4	8.3	6.7	—	—	—	1.819	2
	Shrew	8.9	12.5	10.6	83.9	77.1	80.8	7.1	10.4	8.7	—	—	—	0.781	2
Never	China Bird	—	8.3	3.8	30.4	31.3	30.8	60.7	58.3	59.6	8.9	2.1	5.8	6.797	3
	Stone	—	6.3	2.9	17.9	22.9	20.2	76.8	68.8	73.1	5.4	2.1	3.8	4.776	3
	Water	39.3	37.5	38.5	3.6	20.8	11.5	50.0	37.5	44.2	7.1	4.2	5.8	8.006*	3
	China Lady	—	4.2	1.9	25.0	31.3	27.9	66.1	62.5	64.4	8.9	2.1	5.8	0.030	1
	Candle	14.3	8.3	11.5	7.1	33.3	19.2	73.2	58.3	66.3	5.4	—	2.9	13.447*	3
	Crocodile	—	6.3	2.9	26.8	37.5	31.7	67.9	56.3	62.5	5.4	—	2.9	7.564	3
	Clock	28.6	27.1	27.9	5.4	12.5	8.7	60.7	60.4	60.6	5.4	—	2.9	4.116	3
	Teddy Bear	—	10.4	4.8	28.6	27.1	27.9	64.3	62.5	63.5	7.1	—	3.8	9.295*	3

Eg = Egyptian En = English T = Total

* p <0.05> 0.01

Table (25)
Comparative Responses of Egyptian and English Children Age Groups
(9-11) in Percentage (No. 175, Eg = 91, En = 84)

Class- ifica- tion	Objects	Categories of Response												X ²	D.F
		alive			dead			never			no-answer				
		Eg	En	T	Eg	En	T	Eg	En	T	Eg	En	T		
Alive	Flower	98.9	100	99.4	-	-	-	1.1	-	.6	-	-	-	-	-
	Insect	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Toad	100	100	100	-	-	-	-	-	-	-	-	-	-	-
	Plant	98.9	94.0	96.6	1.1	4.8	2.9	-	1.2	.6	-	-	-	-	-
	Fish	100	100	100	-	-	-	-	-	-	-	-	-	-	-
Dead	Snake	-	-	-	97.8	96.4	97.1	2.2	3.6	2.9	-	-	-	-	-
	Frog	-	-	-	94.5	91.7	93.1	4.4	7.1	5.7	1.1	1.2	1.1	0.618	2
	Fish	1.1	1.2	1.1	97.8	94.0	96.0	1.1	4.8	2.9	-	-	-	2.119	2
	Dogfish	-	1.2	.6	96.7	89.3	93.1	3.3	9.5	6.3	-	-	-	2.691	1
	Lizard	-	-	-	95.6	95.2	95.4	4.4	4.8	4.6	-	-	-	0.0	1
	Shrew	-	1.2	.6	94.5	96.4	95.4	5.5	2.4	4.0	-	-	-	-	-
Never	China Bird	-	1.2	.6	8.8	32.1	20.0	91.2	66.7	79.4	-	-	-	-	-
	Stone	-	-	-	6.6	36.9	21.1	93.4	63.1	78.9	-	-	-	22.287*	1
	Water	37.4	35.7	36.6	9.9	25.0	17.1	30.8	36.9	33.7	22.0	2.4	12.6	19.681*	3
	China Lady	-	2.4	1.1	8.8	31.0	19.4	91.2	66.7	79.4	-	-	-	16.520*	2
	Candle	-	6.0	2.9	7.7	35.7	21.1	91.2	57.1	74.9	1.1	1.2	1.1	28.414*	3
	Crocodile	-	-	-	7.7	42.9	24.6	92.3	57.1	75.4	-	-	-	27.277*	1
	Clock	7.7	26.2	16.6	5.5	21.4	13.1	84.6	52.4	69.1	2.2	-	1.1	25.868*	3
	Teddy Bear	-	1.2	.6	15.4	39.3	26.9	84.6	59.5	72.6	-	-	-	12.584*	1

Eg = Egyptian En = English T = Total

* p < 0.001

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